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Vol. III
TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1940

No. 267

**SIX COMPANIES OF CALIFORNIA, HARTFORD
ACCIDENT AND INDEMNITY COMPANY, ET AL.,
PETITIONERS,**

vs.

**JOINT HIGHWAY DISTRICT No. 13 OF THE STATE
OF CALIFORNIA**

**ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT
OF APPEALS FOR THE NINTH CIRCUIT**

PETITION FOR CERTIORARI FILED JULY 23, 1940.

CERTIORARI GRANTED OCTOBER 14, 1940.

United States
Circuit Court of Appeals

For the Ninth Circuit.

SIX COMPANIES OF CALIFORNIA, a corporation, and
HARTFORD ACCIDENT AND INDEMNITY COMPANY,
a corporation, FIDELITY AND DEPOSIT COMPANY
OF MARYLAND, a corporation, THE AETNA CAS-
UALTY AND SURETY COMPANY, a corporation, IN-
DEMNITY INSURANCE COMPANY OF NORTH
AMERICA, a corporation, AMERICAN SURETY COM-
PANY OF NEW YORK, a corporation, MARYLAND
CASUALTY COMPANY, a corporation, UNITED
STATES FIDELITY AND GUARANTY COMPANY, a
corporation, THE FIDELITY AND CASUALTY COM-
PANY OF NEW YORK, a corporation, GLENS FALLS
INDEMNITY COMPANY, a corporation, STANDARD
SURETY AND CASUALTY COMPANY OF NEW YORK,
a corporation, STANDARD ACCIDENT INSURANCE
COMPANY, a corporation, MASSACHUSETTS BOND-
ING AND INSURANCE COMPANY, a corporation, CON-
TINENTAL CASUALTY COMPANY, a corporation, and
NEW AMSTERDAM CASUALTY COMPANY, a corpo-
ration,

Appellants,

vs.

JOINT HIGHWAY DISTRICT NO. 13 OF THE STATE OF
CALIFORNIA, a public corporation,

Appellee.

Transcript of Record

In Eight Volumes

VOLUME III

Pages 469 to 982

**Upon Appeal from the District Court of the United
States for the Northern District of California,
Southern Division.**

LEWIS MICHAEL LARSON,

Called for the Plaintiff; sworn.

Mr. Marrin: Q. Mr. Larson, will you state your experience in construction work?

A. I began in the year 1900 with the survey party on the location of the present Salt Lake and Los Angeles Railway. I continued with that survey for three years; at the end of which time, I joined the Southern Pacific Company on its construction across the Great Salt Lake, remaining there until 1905, in the early part of the year, when I was transferred down to the tunnel work that was going on, or was about to begin, for the Southern Pacific on the Bayshore section. I was stationed at what was known as the Six Mile House, which is on the southerly end of Tunnel No. 4, and was given the position there of general foreman. My work comprised the tunnel work from that end of the town, followed with a fill of the part of the Bay which now forms the Bayshore Yard, some of the track-laying, the ballasting, and, after that was completed, the erection of the first unit of the terminal building. That carried me to November, 1911, when the Southern Pacific transferred me up onto the Willamette Pacific Cutoff from Eugene to Marshfield in the position of general foreman in charge of the bridge department for the Company. I remained at that position until 1916, when the Southern Pacific part of the construction was completed, and when the main bridges had been sub-contracted, I mean, let out for sub-contract, I was appointed chief inspector. I continued in that po-

(Testimony of Lewis Michael Larson.)

sition until 1917, when the effect of the War caused the suspension of operations by the Southern Pacific in the construction department. In 1918, the Foundation Company of New York engaged me as their superintendent on their shipbuilding program at Tacoma and later at Victoria; completed in the last of 1919; in 1920 and part of 1921, I [530] engaged as a contractor in building operations in the City of Portland; in 1923, the Spring Valley Water Company engaged me as superintendent on the construction of the aqueduct in Niles Canon. That was completed that year. In that fall Mr. W. R. Fontaine employed me as superintendent of some work that he was doing for the Pacific Electric Railway of Los Angeles, Long Beach, San Pedro, and environments, in that vicinity, in the construction of retaining walls and trackage. During that period of time I estimated for W. R. Fontaine and Twohy Bros. Company the Hollywood tunnel, then known as the Hollywood Tunnel, now known as Subway Terminal Tunnel. When the award of the contract was made to them I was made superintendent. I remained with that work until its completion in the early part or possibly the middle of 1925, and as I now recall it at that time I engaged with W. R. Fontaine in the construction business as a partner. We built a bridge for City of Los Angeles, one for the Panama Petroleum Corporation, did considerable pipe and track work for the Panama Petroleum

(Testimony of Lewis Michael Larson.)

Corporation, for the Pacific Electric, and for some private individuals, and also I should remark water tunnels. At the completion of that work Twohy Bros. Company and W. R. Fontaine, who was associated with them, asked me to come to San Francisco and estimate the present Duboce, now known as the Sunset Tunnel. I completed the estimate of that tunnel, but Twohy Bros. decided not to bid on it because they were engaged in so much for the East Bay Utility District that they thought they had better confine their activities to the eastern shore of the bay. They engaged me to estimate the Claremont Tunnel for them, but the estimate that I turned in was not the one on which they bid the job and they were high. As referred to by counsel yesterday, the McDonald & Kahn people were successful, or, rather, the low bidders on [531] that work, and when they were relieved of it and the next lowest bidders were awarded the job I was employed as superintendent. I continued with them until 1926 or 1927, and if I recall correctly it was December, 1929 when that work was completed. In the spring of 1930 Mr. Mead asked me to join him on construction work on a salary and percentage, which I engaged to do. The first job we estimated was the Oyhee Tunnels in Oregon. We were not successful in landing those tunnels, and I made an estimate for him of the three first units of the Figueroa Street Tunnel in Los Angeles. We were

(Testimony of Lewis Michael Larson.)

not successful in getting that work. I estimated the sewer tunnel here in San Francisco for him, which he also did not get. The next was the Newcastle Tunnel at the City of Newcastle, for the California Highway Department, and as I recall it the next was the Wawona Tunnel, and that job we were not successful in landing. At that time the Pack-atowne engaged me to rebuild their plant at Bradley, California. That was sometime about the first of December, as I recall it now, in 1930. In 1930 Sydney Junkins Company of New York and Canada telephoned me, asking me to join them in estimating a tunnel under the city of Vancouver, B. C., that was being built for the C. P. R. The estimate was completed in the latter part of December, and I was engaged by Lindgren-Swinnerton people to estimate the Boulder Canon Tunnel, which the Six Companies later on received the award for and completed the job. My next association, I think, was with Merritt, Chapman & Scott. They asked me to construct three tunnels for them in the vicinity of Ventura, California, which I did, completing them, if I recall correctly, in the latter part of 1932. I then moved to Los Angeles and estimated for Lindgren & Swinnerton the Outlet Tunnel from San Gabriel Dam No. 1. That was followed [532] by an estimate of the Hetch Hetchy, the completion of the Hetch Hetchy Tunnels that were then being offered to contractors. After completing that my

(Testimony of Lewis Michael Larson.)

next estimate I think was this tunnel over here, under the Island, Yerba Buena Island, in connection with the Oakland-San Francisco Bay Bridge.

Mr. Tinning: Q. Mr. Larson, will you tell me who you did these various things for? The last one I think was Merritt, Chapman & Scott, and then Lindgren & Swinnerton.

A. Lindgren & Swinnerton on the Island Tunnel.

Q. What about the Hetch Hetchy?

A. The Hetch Hetchy was also for Lindgren & Swinnerton, and the Arundel Company of Baltimore, Silas Palmer and Barrett & Hilp. Following that I think my next was the estimate of the San Jacinto Tunnel of the Metropolitan Aqueduct, and the Metropolitan Water Company of Southern California, for a group of contractors who bid under the name of the Metropolitan Engineering Corporation. Following that—possibly I am a little out of order, but it is immaterial. Following that I estimated for the Walsh Construction Company the Val Verde Tunnel, the Bernisconi Tunnel, the Iron Mountain Tunnel, the Cottonwood Tunnel, and the Coxcomb Tunnel in the Southern California Water Department, known as the Metropolitan Water District of Southern California. I was then engaged by W. A. Bechtel Company to estimate for them the Broadway low level tunnel over here in Oakland, in No. 13 Highway District. As I recall it, my employment with them began on the 25th of February, 1934. I arrived from Los Angeles I believe upon

(Testimony of Lewis Michael Larson.)

the morning of the 26th and proceeded immediately to their office in the Stock Exchange Building, where I was given plans and specifications for this tunnel and directed by Mr. Stephen Bechtel, the President of the Company, to work in collaboration with Mr. Fontaine on the estimate of that work [533] particularly the tunnel.

Q. Is that the tunnel, Mr. Larson, which is described in the contract and Plaintiff's Exhibit No. 3 which is involved in this case? A. Yes.

Q. Will you proceed to state what you did in making that estimate?

A. The first day I spent in reading the specifications and looking at the plans. If I recall correctly the next day in company with Mr. Fontaine I visited Mr. Boggs, the District Engineer, as the plans indicated that he was the engineer who was in charge of the work. It was important to have information directly from him in regard to his thought on various phases of the work.

Mr. Wittschen: So that there will be no mistake about the record, it is understood that the objection to this testimony of Mr. Larson will run in the same manner as it did to Mr. Calhoun's; in other words, we do not want to interrupt, knowing what the Court's ruling will be, but we will make the objection on all of the grounds stated to the testimony of Mr. Calhoun, starting with this last question.

Mr. Marrin: As I understand, your objection is to anything that Boggs said to him?

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: On all of the grounds stated to the previous questions.

The Court: Let the record show the objection and it will be subject to the same ruling, motion to strike, and an exception.

Mr. Marrin: Will you proceed?

A. I do not recall the exact date, but it was probably about February 22 that I called in company with Mr. Fontaine on Mr. Boggs and told him that the purpose of our visit was to discuss the project in a general way, and if I remember particularly at this time the thought developed in my mind that I would like to have a little clarification on the concrete method, and I asked Mr. Boggs if [534] we were successful in getting the bid could we pour the lean or concrete with the main part of the lining? Further in the specifications I had noticed the walls were boarded up to point not lower than seven feet, that is, the meeting line of the arch and that arch section, and at a later time I asked Mr. Boggs if there would be any objection to pouring it at one time, and he said there would be none. In looking over the plans I had noted that the long radius formation of the side walls from the radius of the arch gave the tunnel position a sort of battered position, that is, it kind of sloped in; that had an important bearing in a way when connected with the other items in the specifications in helping me to form a conclusion. I drew from that the conclusion that it was reasonable to esti-

(Testimony of Lewis Michael Larson.)

mate from the type of construction that no inordinate pressures might be expected from the side on account of the shape of the tunnel.

Mr. Tinning: If your Honor please, I move that the last answer of the witness go out as a conclusion and not responsive.

The Court: The conclusion may go out.

Mr. Marrin: Q. Will you state just at this time what you did, confining your testimony to what you did and said to the District Engineer or to his representative?

A. Not any conclusions that I drew, do I understand.

Q. No, not at this time. I will ask you about those later.

A. Well, in this discussion I think we asked—I say “we,” because Mr. Fontaine accompanied me,—Mr. Boggs about the general lay out of the project. He told us where the tunnel began and about where it ended, and directed us to go out to see Mr. Gelston, whom we would find at the east end of the proposed tunnel. We drove out over the old Tunnel Road, through the old tunnel, and down to the point indicated by Mr. Boggs, and saw Mr. Gelston. Mr. Gelston explained— [535]

Mr. Wittschen: Pardon me. I think the question has been answered. He is about to give conversation.

The Court: Proceed by question and answer.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. What did Mr. Gelston tell you?

Mr. Wittschen: Objected to as immaterial, irrelevant, and incompetent, and not binding upon the District, calling for hearsay, and not bearing on any issue in this case.

The Court: The objection will have to be sustained.

Mr. Marrin: Q. Who was Mr. Gelston?

A. We did not have any definite information as to who Mr. Gelston was, but drew the inference from Mr. Boggs—

Mr. Tinning: I would like to take exception to that.

Mr. Marrin: Q. What did you do then?

A. Could I refer again—

The Court: Q. What you, yourself, did.

A. I viewed a test pit that had been dug some time prior, just how much prior to the visit I do not know, but it was in the vicinity of the present Claremont Avenue Bridge and portal building. It was a test pit as I recall it now approximately four feet square and possibly eight feet deep; I could not tell you how deep, it had some water in it. The indications on the wall of that pit were that the ground was firm, it was in what is known as Orindan formation. I am a little lost on the limitation there.

The Court: You can state what you, yourself, did at that time.

(Testimony of Lewis Michael Larson.)

A. I looked over the project or the physical aspects in a general way on the east end.

Mr. Marrin: Pardon me just a moment. Are you willing to stipulate that Mr. Gelston was the Assistant Engineer of the District at that time?

Mr. Tinning: Yes.

Mr. Marrin: In view of that stipulation I am going to ask [536] the question again as to what Mr. Gelston said to you when you saw him at the east end of the tunnel.

Mr. Wittschen: Objected to on all the grounds previously stated.

The Court: I will allow it, it is preliminary under the same rule that I allowed the other, and an exception.

Mr. Wittschen: Note an exception.

The Court: So that either side is not misled to your injury, and I cannot conceive you can be injured, since you have made your objection, but if you want a final ruling on this testimony and insist upon it I shall rule. But, as I indicated to you, what I do, not only in this case, but in the other ones, both sides are protected legally upon the record and you do not waive any right.

Mr. Wittschen: I understand that at a later time we may argue it.

The Court: All right, proceed.

Mr. Marrin: Q. Will you state, Mr. Larson, what Mr. Gelston said at the time you saw him at the east end of the tunnel?

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: I interpose the objection to all of these questions; I will make the same objection to that on all the grounds stated.

The Court: The same ruling, and so that the record may be ~~protected~~ note an exception following it.

Mr. Wittschen: Exception.

Mr. Marrin: Proceed, Mr. Larson.

A. As I recall the conversation Mr. Gelston merely indicated that this test pit had been dug at that point for an observation, to determine what the ground conditions might be. He indicated or said that the water that was in the bottom of the pit might be rain water, it might be overflow from an adjacent creek. That is my recollection of the conversation. I pointed out to Mr. Fontaine, who was [537] less familiar with the Orindan formation than myself, some exposures of the Orindan, and made an arrangement later on for a further inspection of the Orindan formation at a future date. At the termination of this investigation at the portal at this particular time we drove back through the old tunnel, and it is my recollection at the present time that we parked our car at the portal of the old tunnel on the east end.

Mr. Marrin: Q. Can you state where the location of that old tunnel is, relative to the tunnel which is involved in this contract approximately?

A. Yes, it is a little bit to the east of the present

(Testimony of Lewis Michael Larson.)

low-level Broadway Tunnel, and at an elevation, I should say, between 200 and 300 feet higher. That could be determined, however, from the data. The reason I was interested in it was it passed through a formation that would be a very similar formation to a large portion of the formation that appeared that the new tunnel was going to be projected through. If my recollection is correct we parked our car at the east end of the tunnel, and walked in to make the inspection on this particular day of the formation. I noticed that at each portal that the timber was depressed a little bit, and at the point if there had been a material weight on it the tunnel would have collapsed.

The Court: That is the old tunnel?

A. In the old tunnel. There was very little evidence of much repair work, indicating to me that there must have been very little weight. I appreciated that this depression of the timber might come from a development of weight with years passing by and the wash of material, and it also indicated that there could not be very much of a menace in the formation, otherwise the tunnel would have collapsed. In the major portion of the tunnel which lay in what is, I understand, Chert formation, there was lagging overhead, that is, it was covered with timbering and checks, and over those checks [538] were timber that are termed lagging, and over a portion of the side, all of the side could not be seen, but there were long stretches in there where you

(Testimony of Lewis Michael Larson.)

could see the formation, and there were places there where there had been no attempt at all at lagging other than to prevent spalling into the traveled portion of the tunnel, and you could make a fairly good inspection of the formation in that section. I noted and mentioned to Mr. Fontaine that there was no weight on there and no maintenance, that is, no replacement timber during the period since the tunnel was constructed, which I understood was in 1903. We then got back into our car and proceeded through this old tunnel and parked at a wider place in the road west from this old tunnel. Mr. Gelston there told us that there was a test pit over the future tunnel from 100 to 150 feet down the grade from the crossing of this old Tunnel Road. He did not take us down there, but Mr. Fontaine and I went to look at it. The test pit was apparently about six feet in diameter at the top, possibly two feet at the bottom, and I formed the idea at that time that it would not exceed 8 feet deep. The formation was badly broken and we could form no conclusion as to the character of the material that might be encountered in the tunnel, and we proceeded back to our cars. We then drove down the Tunnel Road to a point where there was a side road that led into the west portal of the projected tunnel. At that point we parked our cars again and walked along the old road. Mr. Gelston pointed out such parts of the construction as were visible from that point.

(Testimony of Lewis Michael Larson.)

I might mention here that our thought was to look at a drift or a small tunnel that the specifications had mentioned had been driven in that drift. I wish also to state at this particular time, because it has an important bearing, that I will bring out later, that there was also a geological report that could be read [539] in the District Office. We proceeded to the proposed location of the tunnel. Mr. Gelston pointed out about where the tunnel portals would be. We went up on the ground over the tunnel in the vicinity of the portal with a view to try and determine if we could what the formation might be in the tunnel. I noted a creek running over what would probably be near the portal of what is now, I think, termed the South Tunnel, it was the up-grade tunnel. At that time there was not a great amount of water pouring over it, but the wash in this creek indicated that there would not be much trouble in cutting, I mean that the material was not of that nature where it could be readily removed by the flowing water; from the North Tunnel Portal, on the bluff of the hill, the hill had slid away there and it had a high elevation above the south tunnel, and I tried to form a conclusion there by going around in the rock and seeing whether that was the natural formation; there was nothing really definite that could be determined from it, though it did not appear to have been very much disturbed over that tunnel. We then proceeded to this drift

(Testimony of Lewis Michael Larson.)

that I mentioned, and I noticed that there had been some retimbering done at the portal of this drift which Mr. Gelston explained had been placed there for the safety of people who would wish to look into the drift; that some of the previous timbers had collapsed. It was noted part of the wash from the creek that I have mentioned over the South Portal apparently would reach that location when the water was high and had a sort of muddy body. On the left-hand side of the portal of the tunnel I noticed the formation that had withstood erosion for no one knows how long, and it gave the impression it was a very hard formation. We went on to the tunnel, Mr. Fontaine and I did, with a view to trying to determine what formation we would find there, and make such other observations as were pertinent, [540] among other things the appearance of the timber, which was thought necessary by the District to hold the tunnel. My recollection now is, although it may not be correct, it was 6 by 6 posts and 6 by 6 caps, and the side and the top were lagged, that means they had lumber outside of the posts and over the caps to prevent the material from falling into it. As we proceeded further into this drift we found that the lagging was becoming less frequent, and toward the deeper part of the drift and the sides my recollection is for a distance of probably 20 or 30 feet there was no lagging. I tried to remove some of the material by hand and found that I could not do so, and we hunted around

(Testimony of Lewis Michael Larson.)

for something to check it, as to what the texture of the material might be. In the forward end of the drift I found a rock that probably was half the size of my hand, which I took out and took with me with a view to observing the texture. Mr. Gelston stated that this tunnel was in line with the future down-grade tunnel at an elevation of approximately 15 feet above sub-grade.

Q. Mr. Larson, I show you a map which has on it "Map Showing Location of Prospect Drift Driven in 1932 at Site of West Portal." Does that map show the location of that drift?

Mr. Wittschen: In order to preserve the record we make the same objection to all of these extraneous matters that are no part of the plans and specifications, as entirely immaterial, irrelevant, and incompetent, and endeavoring to change the contract by parole evidence.

The Court: The same ruling.

Mr. Wittschen: Exception.

A. That is approximately the location as I recall it. It has the relative location with the North Tunnel, the down-grade tunnel that I observed at that time, and about the same distance [541] from the portal, as I recall it.

Mr. Marrin: I would like to offer that in evidence.

The Court: It may be admitted and marked.

(The map was marked "Plaintiff's Exhibit 25.")
[Set forth in the Book of Exhibits at page 260.]

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. Now, Mr. Larson, will you point out to the Court on that map where this prospect drift was with relation to the portal of the tunnel?

A. As I recall the drift—this is the portal of the tunnel, the west portal; this section is about 50 feet in length; that was approximately the end of the drift as I understand it at that time; that is the forward position of the drift, the drift being about 125 feet long. The portion I spoke of, prior to that, where this hard formation lay on this side, and the portion where the timbers had caved in, lay in this position here. Does that cover the ground? [542]

Mr. Marrin: Q. Yes. What subsequently was done with this area in here in which this prospect drift had been driven?

A. That was known as the approach cut, and was later on excavated by Subcontractors McKinley and Crowell.

Q. The prospect drift did not extend into any part of the tunnels as they were subsequently excavated?

A. No. There was no evidence of them there. When the excavation of the approach cut was completed, the prospect drift was entirely obliterated.

Q. What did you next do, Mr. Larson, in connection with—

A. Perhaps I should mention that my impression of the material that would be encountered was

(Testimony of Lewis Michael Larson.)

that it would be very firm. The drift, in other words, was—

Mr. Wittschen: I ask the volunteer statement go out.

The Court: It may go out.

Mr. Marrin: I think, your Honor, this witness is qualified to express opinions concerning those matters.

The Court: Well, that was a voluntary speech.

Mr. Marrin: Q. Would you tell us, Mr. Larson, the impression of the formation which you got from this inspection—

Mr. Wittschen: We object to that as incompetent, irrelevant and immaterial.

The Court: Objection will be overruled and subject to the same motion.

Mr. Wittschen: Exception.

The Court: Subject to a motion to strike over the objection of counsel, it will be received.

Mr. Wittschen: Exception, please.

The Witness: A. My impression is: the formation we would encounter in the tunnel would be a very satisfactory material.

Mr. Marrin: Q. Based on your examination of this drift?

A. Based on my examination of this drift; and there was an [543] apparent wash in the creek above and the general slope of the material over the North Tunnel, indicating that, if there were any deposit on there, it would be of a minor depth, because it would have a flatter slope.

(Testimony of Lewis Michael Larson.)

Q. Will you state what you did, next, in connection with making the estimate?

Mr. Wittschen: To which we will make the same objection.

The Court: The same ruling!

Mr. Wittschen: Exception, please.

The Court: Q. What did you do next?

A. I left this tunnel drift in the company of Mr. Fontaine and Mr. Gelston; and, as we proceeded through the old tunnel, different features of the work were pointed out by Gelston to us. The next trip—Maybe I better carry my trips separately in my estimate, for the time being. The next trip there was made in company with Mr. Fontaine; and, as I recall it, two or probably as much as four days later; for the purpose of further examining formations that we were likely to encounter in the tunnel drift. On this trip, we went over practically the same ground that we had on the previous one, with the exception we did not go into the drift, as our first inspection had been very thorough on that; but, in this trip, I took Mr. Fontaine down—or, rather, in this case, I should say up to what was known as the old Fish Ranch Road. We passed up over the divide and, on going down toward Berkeley, we ran across some relief workers who were widening the road which has now become known as the Claremont Avenue Extension. I had in mind showing Mr. Fontaine exposures of Orindan formation that must lie on that road. We were fortunate in finding these re-

(Testimony of Lewis Michael Larson.)

lief workers far enough advanced on their work that they had made many exposures of Orindan formation, and that gave us an opportunity,—a good opportunity,—to view [544] it in its different component parts. It is made up from river deposits; and, in river deposits, we have sometimes gravel, sometimes mud. That was clearly indicated in this formation. We drove back over the old Tunnel Road, and decided we would call on Dr. Louderback, on this trip; which we did, at his office at the University. We stated to——

Mr. Wittschen: Just a moment. Are you going to another conversation now? I would like you to ask another question.

Mr. Marrin: Yes.

Q. What did Dr. Louderback say to you at the time you called there?

Mr. Wittschen: We object to that as incompetent, irrelevant and immaterial, and calling for hearsay, and not binding on the District in any way, and not explaining plans and specifications.

Mr. Marrin: Will you stipulate Dr. Louderback is the man who made the geological report?

Mr. Wittschen: Yes.

The Court: Well, the report will have to speak for itself.

Mr. Wittschen: It is in evidence.

Mr. Marrin: I want to show, and offer to prove, by this witness, your Honor, that Dr. Louderback told him he had made the report and that, also, he

(Testimony of Lewis Michael Larson.)

referred them to a chert formation on the Claremont Road, which they examined.

Mr. Wittschen: Nowhere in the plans and specifications does it say bidders should go out and consult Dr. Louderback or anybody else on the side.

The Court: The objection will have to be sustained. The report is in, and we will have—and will have to speak for itself.

Mr. Marrin: Very well, your Honor.

Q. What did you then do, leaving out the conversation with Dr. Louderback?

A. I went to look at the chert exposure down on the Fish Ranch Road. After having seen that, in company with Mr. [545] Fontaine, I returned to San Francisco to the Bechtel office. I had one more subsequent visit—We made one more subsequent visit, rather, in which we were accompanied by Mr. Stephen Bechtel, by Mr. Kenneth Bechtel, by Mr. W. A. Bechtel, Junior, by Mr. Henry Kaiser—When I say “we”, “we” means Mr. Fontaine and myself. We took them over practically the same ground that I have described, and when we came to the drift, I took Mr. Henry Kaiser into the drift to show him the formation there. My recollection is: there was nobody else besides Mr. Kaiser and myself that went in at this particular time. During this period, when I was not visiting, I was in the process of estimating the tunnel, the first of which is a careful survey to discover everything I can; and the takeoff of material and the quantity that there is to take

(Testimony of Lewis Michael Larson.)

into consideration. In the taking off of material, it is necessary to get prices on the materials that have to be purchased. As this takeoff was completed, I passed that information to Mr. Orselli. He was one of the members of the W. A. Bechtel Company, who was to assist me in checking extensions on my figures and my totals, and to get me the information that was necessary for me to complete the estimate of getting material price quotations. When the quantities were pretty well taken off, I began on the real estimate itself, and, as the worksheets were completed, I passed them to Mr. Fontaine, if he were present. Mr. Fontaine had many duties, and sometimes he was not there when I had a worksheet completed; in which event, I passed the worksheet to Mr. Orselli, and Mr. Fontaine would have the opportunity of observing it later. Mr. Orselli, in turn, passed the information to Mr. Shaw, who was then acting as chief engineer for W. A. Bechtel Company. That was the information I had. He brought it up into book form, in the way the W. A. Bechtel Company wished it placed.

Q. Mr. Larson, I show you Plaintiff's Exhibit No. 22, which is [546] entitled "Geological Report," and I will ask you to look at that and state whether, in connection with making the estimate, you examined that report, or any part thereof.

Mr. Wittschen: May I have the answer "Yes" or "No"?

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. Will you say "Yes" or "No" to that? A. Yes.

Q. Which part?

A. The part beginning here on page 13.

Q. And running through to what page?

A. Running through and including page number 18.

Q. I also show you, Mr. Larson, Plaintiff's Exhibit 23, which is a profile, and ask you, in connection with the making of the estimate, whether you saw that profile.

A. I did. I had possession of both that and that portion of the geological report I refer to here.

Q. When did you first see the part of the geological report which you have stated you had before you, in making this estimate?

A. My recollection is that it was in the early part of—oh, before the 10th of March; it was March, because I did not join with them until February; so it was in the early part of March.

Q. Of what year? A. 1934.

Q. Did you have the profile before you?

A. Yes; I had this profile or one similar to it, yes. It was handed to me by Mr. Calhoun.

Q. Was that part of the geological report, which you have identified as having been before you, handed to you by Mr. Calhoun? A. It was.

Q. Did you read that part of the geological report which you had? A. Very carefully.

(Testimony of Lewis Michael Larson.)

Q. Did you draw any conclusions from that, as to the character of the ground through which the tunneling would be constructed?

Mr. Wittschen: I object to that as incompetent, irrelevant and immaterial, and not binding on the defendant in this case, and expressing something not considered by the contract between the parties.

The Court: Objection overruled. I will allow it to come in [547] over your motion to strike and over your objection.

Mr. Wittschen: Exception, please.

The Witness: A. I formed very definite conclusions.

Mr. Marrin: Q. Will you state what they were?

Mr. Wittschen: Same objection.

The Court: Same ruling.

Mr. Wittschen: Exception.

The Witness: A. My understanding of the report was that, in the major portion of both tunnels the ground would be self-sustaining. To me, "self-sustaining" means no need for artificial support. I noted, in the western portion of the tunnel, over the western portal, that we might find some wash, and we might find water that would be a sort of menace until we got under the main portion of the ground; and I noted that the slope of the hill indicated in the sketch would throw the tunnel under the undisturbed portion of the ground pretty quickly. I noted in the report, as I understood it, that not much trouble might be expected from this material.

(Testimony of Lewis Michael Larson.)

Those were my conclusions from having carefully studied the report, and the sketch that accompanied the report. On the basis of this, I proceeded to lay out the method of driving; that would be the excavation, in the western portal section——

Mr. Marrin: You are getting to another subject.

The Court: We will take a recess.

(After Recess)

Mr. Marrin: Q. I draw your attention to a photograph, which is on the easel. Will you explain what that represents?

A. That represents the chert exposure to which I made reference. There have been some changes. This was in a sort of arched condition, as I saw it; I could not tell; but I suppose it is——

Mr. Wittschen: We cannot hear the witness. [548]

Mr. Marrin: Q. That was the chert exposure which you saw?

A. That was the chert exposure that I saw, and the one to which I took Mr. Fontaine.

Mr. Marrin: We offer that in evidence.

Mr. Wittschen: We object to that as incompetent, irrelevant and immaterial, and not being in any way binding on the defendant.

The Court: I will allow it under the same ruling.

Mr. Wittschen: Note an exception, please.

(The document was marked "Plaintiff's Exhibit No. 26.")

Mr. Marrin:—Q. Mr. Larson, I draw your attention to Plaintiff's Exhibit 3, specifications for

(Testimony of Lewis Michael Larson.)

construction of project. I think you have already testified that you studied those specifications in connection with the making of your estimate?

A. I did.

Q. Did you form any opinion of the condition of the ground which would be encountered in driving the tunnel, from your study of those specifications?

Mr. Wittschen: We object to that as incompetent, irrelevant and immaterial, and calling for his conclusion on a matter that could not possibly bind this defendant.

The Court: Let it come in, subject to a motion to strike and over your objection.

Mr. Wittschen: Exception.

The Witness: A. Yes, I did.

Mr. Marrin: Q. What?

A. The impression that I got from the specifications was——

Mr. Wittschen: Just a moment. I want to make the same objection, but add to it, further: the specifications speak for themselves and are to be construed by the Court, and not subject matter calling for the opinion and conclusion of this witness.

The Court: Will you make reference to the part of the specifications you base your judgment or opinion upon? [549]

Mr. Marrin: I am going to ask him that at this time.

The Court: Ask it directly.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: I am asking for the opinion, your Honor, that he formed as to the ground condition there of the tunnel.

The Court: Based on what?

Mr. Marrin: Based partly on these specifications.

Mr. Wittschen: What particular part do you claim to be misleading in any way?

Mr. Marrin: I was going to follow that by asking him that.

The Court: That was the reason I suggested it. Proceed.

Mr. Wittschen: Exception.

Mr. Marrin: I am going to ask him to draw our attention to the specific provision upon which he relied in forming his conclusion.

Q. Will you state, first, the opinion you formed as to the ground conditions, from studying those specifications?

Mr. Wittschen: I object to that as incompetent, irrelevant and immaterial, too general, not binding on the defendant, and asking him to interpret the specifications, which should be interpreted by the Court.

The Court: He may answer "Yes" or "No," if that is possible, and then follow it up by indicating what portions of the specifications he based it on. That is my suggestion. I will allow it, subject to a motion to strike and over your objection.

Mr. Wittschen: Exception.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. Will you answer the question?

A. I was influenced by the clauses in the specifications.

Mr. Wittschen: I move the answer go out. We are not interested in whether he was influenced. They are charging us here with having something misleading in the specifications. I think he ought [550] to point to something that misled him; and it is for your Honor to decide whether that was misleading.

The Court: I have allowed the question, preliminarily, under the issue presented of what will follow—the purpose of his testimony; if the purpose is what counsel has indicated.

Mr. Marrin: The purpose of this testimony is to show, first, that, from certain provisions in the specifications, self-supporting ground is indicated; the provision respecting timbering, and other provisions in the specifications; secondly, showing that that was a misrepresentation of the conditions, first—and, secondly, it goes to the issue of mistake.

The Court: Well, then, we will have to go to the provisions of the specifications to ascertain in what manner you were misled, if at all.

Mr. Wittschen: I would respectfully like to urge that I think this goes to a very important portion of the case; and I don't think those specifications are open to the interpretation of employees of the plaintiff to say that they were misled by them, unless your Honor concludes, from an interpretation, that they are misleading. You cannot draw infer-

(Testimony of Lewis Michael Larson.)

ences from specifications, and say, from those, that there was something in there that was misleading or deceptive, at least not in a general way, until he points out specifically the place he relies on. Then, I say, when that happens, it is for your Honor to interpret that language and not for the witness.

The Court: It might be that; that is the reason I suggested it.

Mr. Marrin: I will withdraw the question.

Q. Mr. Larson, will you point out the provisions in the specifications upon which you placed reliance in determining the ground conditions through which the tunnel would be constructed? [551]

Mr. Wittschen: I object to that as incompetent, irrelevant and immaterial, too general, calling for an opinion and conclusion of the witness on an immaterial point, and calling for a conclusion that is not binding on the defendant.

The Court: I will allow it.

Mr. Wittschen: Exception.

Mr. Marrin: Q. Will you proceed?

A. May I read it?

Q. You may call our attention to the specific provision, pointing out the page and the specification number, and read it.

A. May I state why I drew the conclusion?

The Court: Q. First indicate the specification.

Mr. Tinning: Q. And, Mr. Larson, will you give us the page and the section number?

(Testimony of Lewis Michael Larson.)

A. It is on page 59, in the section termed "Over-break." I will read:

"Where timber is employed for tunnel timbering it shall be removed before any concrete is placed, and any spaces outside the neat lines of the concrete structure caused by such removal shall be filled with concrete as above provided. In the event that it is found impracticable, in the opinion of the District Engineer, to remove timbering or portions thereof, such timbering may be allowed to remain permanently in place, but in no case shall such timber so remaining be allowed to project into the neat lines of the concrete structure. Where timber is permitted to remain, all spaces outside of the neat lines of the concrete structure shall be filled with concrete mixed in the same proportions and placed at the same time as the concrete in the neat structure."

The Court: Q. That is to say the engineer was to determine that?

A. Yes, the engineer is to determine it.

Q. He had the final word, under the plans and specifications?

A. Yes; that is correct. [552]

On page No. 60, the paragraph at the right hand side of that page, under Section 32. I might drop back and repeat the whole clause there beginning with "Timber."

• Mr. Tinning: I have a different paper if you indicate the subject-matter that will help a lot, Section 32 (e), is it not?

(Testimony of Lewis Michael Larson.)

A. Section (e), yes. The title is "Timbering". "The term 'Timbering' as used herein shall include all wooden pieces or structures used to support the earth or rock adjacent to any excavation. The Contractor shall furnish, put in place, construct and maintain all timbering necessary to support the sides and top of the excavations, preliminary to the placing of the concrete lining. The timbering shall be so constructed as to prevent any movement or caving which might in any way injure the proposed structures or endanger any person. Wherever, in the opinion of the District Engineer, sufficient or proper timbering has not been provided, the Contractor shall furnish additional timbering; but neither compliance with the District Engineer's instructions nor failure of the District Engineer to give such instructions shall relieve or release the Contractor from his responsibility for the sufficiency of the timbering.

"It is the general intent of these specifications that all timbering shall be removed from the excavation before concrete is placed. Should conditions arise where, in the opinion of the District Engineer, it is impracticable to remove certain timbers or structures, such timbering, upon the written consent of the District Engineer, may be permitted to remain, subject, however, to the provisions herein contained in respect to clearances outside of the concrete lining. Timbers allowed to remain in place shall in no case project into the neat lines of the

(Testimony of Lewis Michael Larson.)

concrete structure, and, in the event that it is apparent, during the process of excavation and timbering, that the safety of the [553] excavation will require timbering to remain in place, the Contractor shall enlarge the excavated section to the extent necessary to set the timbers outside of future concrete lines; timbers found to project within the concrete lines shall be removed and reset before concreting. Permission to allow timbers to remain will not be granted for any other reason than to secure the safety of the structure.

"Where timber is allowed to remain it shall be keyed or wedged firmly against the adjacent rock or earth, and shall be securely fastened, spiked or bolted so that no movement, shifting or settlement shall occur. All joints shall have full and firm bearing, timber to timber, without shimming or blocking. All timber, whether permanent or temporary, shall be sound Douglas fir and no second-hand material shall be used, provided, however, that material already used in tunnel construction and removed in good condition, may, with the approval of the District Engineer, be reused where conditions permit.

"Timbering shall be placed in such a manner as to be readily removed, without endangering the safety of the excavation or causing weakness or excessive stresses in adjacent timber sets or concrete structures, and any damage which may occur shall be remedied by the Contractor at his own expense, including the removal and replacement of any con-

(Testimony of Lewis Michael Larson.)

crete which has, in the judgment of the District Engineer, been damaged or subjected to excessive loads on account of such operations.

“Lagging behind timber sets shall be restricted to the least extent consistent with safety, and, if, in any case, permitted by the District Engineer to remain permanently in place, shall be so spaced as to permit the unrestricted flow of concrete through the lagging to fill any spaces between the lagging and the excavated surfaces.” [554]

Mr. Wittschen: Would you mind reading the one as to Structural Steel Supports?

Mr. Marrin: I asked the witness to read those sections of the specifications upon which he based his opinion as to the nature of the ground.

The Court: The thought being not to limit him to any section or portion of the section?

Mr. Marrin: I did not want to limit him to any part upon which he based his opinion.

Mr. Wittschen: The next paragraph is Steel, and it is pertinent.

The Court: Q. Did you take that into account?

A. The steel?

Q. Yes.

A. I took it into account only in this way, that it was optional to use steel instead of timber, where the conditions demanded that one or the other might be used; it was optional. If I may be permitted to state—

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: Just a moment, you have answered the question.

Mr. Marrin: I think so. Do not volunteer until I ask a question. Do you want the section read?

Mr. Wittschen: Yes.

Mr. Marrin: Will you read that?

A. It is entitled "Structural Steel Supports," Section (f): "Structural steel shapes may be used to support the sides and tops of the excavation, either entirely or in connection with timbering. Where structural steel ribs are used the same may be allowed to remain in place, provided that they do not project into the concrete more than four inches (4") beyond the neat lines of the concrete structure. The manner of framing, supporting and removal shall be such as to fully support the excavation while in place, and permit removal without endangering other parts of the structure. [555] All timbering used in connection therewith shall conform to the requirements set forth under 'Timbering,' including the removal before concrete is placed. Where steel is permitted to remain in place, all spaces between the steel and the adjacent earth or rock shall be thoroughly filed with concrete so as to provide firm and uniform bearing and the steel ribs and liners shall be so constructed and erected that no settlement or movement will occur. Liner plates allowed to remain in place shall not project into the neat concrete structure."

(Testimony of Lewis Michael Larson.)

Q. You might as well read the rest of it on timber and then we will have it complete.

A. "(g) Types of Tunnel Section.—Two typical tunnel sections are shown on the plans. The District Engineer shall determine which section shall be used in any specific location in order to meet varying conditions which may be encountered. In general, it is expected that the Type 'A' section will be used throughout the major length of the tunnels, but if conditions arise which, in the judgment of the District Engineer, require the use of Type 'B' section, the Contractor shall make such modifications in construction as may be necessary.

"No extra payment will be allowed on account of such change, but the unit prices bid for the various units or types of work shall include full compensation for such work, labor, material or equipment as may be necessary."

Q. What opinion did you form as to the condition of the ground from these provisions of the specifications which you just read?

Mr. Wittschen: Objected to as immaterial, irrelevant, and incompetent, and asking the witness to construe the contract, and invading the province of the Court.

The Court: I will allow it subject to the same ruling.

Mr. Wittschen: Note an exception. [556]

A. In order to make any estimate you have got to draw a conclusion on every part—

(Testimony of Lewis Michael Larson.)

Q. Just answer the question. Will you read the question?

(Question repeated by the reporter.)

A. That in the main the timbering would be required to be removed, which implied a self-sustaining rock.

Mr. Wittschen: I ask that the last portion of the answer go out.

The Court: The "implied" may go out. Develop the facts, whatever they may be.

Mr. Marrin: Q. From your experience in tunnel construction, could you state whether or not timbering could be removed where the ground is not self-supporting?

Mr. Wittschen: Objected to as asking for the opinion and conclusion of the witness, and endeavoring to construe the contract, and entirely immaterial.

Mr. Marrin: I think that he has the qualifications to answer as an expert. He has had long experience in tunnel work.

The Court: That may be true, but tunnels are driven under different conditions. We have plans and specifications here. His answer will have to be based on conditions here.

Mr. Wittschen: Might I call attention to the fact that the plans provide if the District Engineer insists it all will remain in.

Mr. Marrin: No, the plans do not quite provide that. They require the timbering in unless the Dis-

(Testimony of Lewis Michael Larson.)

trict Engineer, by order, requires them to be taken out, or permits them to remain in.

Mr. Wittschen: He can permit them to remain in.

The Court: As I gathered from the statement yesterday, the engineer had the final say as to whether they would remain in or be removed. In fact, they had to have his consent before removal.

[557]

Mr. Wittschen: No, they had to have his consent for them to remain, but if he wished to he could leave them all in.

Mr. Marrin: What I will offer to prove by this witness, so that it may be clear to your Honor, is this, that he was furnished with certain specifications and geological reports, and he made an examination of the ground, and conclusions which he arrived at in planning the method of procedure, and the cost of constructing these tunnels. Now, your Honor may or may not feel that he was justified in relying upon these things, but we think we are entitled to show this certainly on the issue of mistake, and the fact as to what the conditions were. We have to show that not only did the district furnish these things and make these representations, but that the plaintiff relied on them.

Mr. Wittschen: In that connection, in the first place, the district could not possibly be bound by what somebody interpreted in a set of plans. In the first place, it is for your Honor to determine

(Testimony of Lewis Michael Larson.)

whether or not they were misled, and in these plans and specifications the District could have had every stick of timber removed or every stick left in, depending upon how the Engineer of the District felt. Furthermore, on this issue of mutual mistake, if that is what counsel is trying to show, I say he is completely out on that, because the cases hold that mutual mistake must be pleaded, and under the form of common count you may show fraud if you like, you may show under a common count, particularly where the answer is in, any reply where a certain defense is set up; in other words, where we set up that the plans and specifications show so and so, they might come in and show that their bid was procured through fraud, but where they want to set a contract aside on the ground of a mutual mistake, there was a case decided within the last two months by the Supreme Court of this State, and I will just read one excerpt from it. There are other [558] cases on it.

“Where a cause of action is founded upon an alleged mutual mistake it is necessary that the complaint contain a proper allegation thereof.”

Now, there is no element of mutual mistake here. What counsel started in to prove was that he was misled, or his client was misled by these specifications. Now, I say these specifications that require timbering in great detail, and this does not go to the weight of the evidence, it goes directly to the point, could not possibly mislead anybody that the

(Testimony of Lewis Michael Larson.)

ground was self-supporting, and where the District Engineer, under the evidence that is now in before your Honor, might order all timber out, or might permit it to remain, then I say it is for your Honor to determine whether or not these provisions are misleading, and not to have the gentleman who is on the stand say they misled me—whether they misled him or not is immaterial. The question is whether they mislead.

Mr. Marrin: We say that this witness was misled. He was the man that made the estimate.

The Court: Assuming that your position is correct, and his conclusion is it was misleading, I must finally determine whether or not he was misled, that is entirely for the Court—he was misled by what?

Mr. Wittschen: He said by this language, I assume was the question. But even if he was misled, that is not the criterion, but is the language misleading to a reasonable person?

The Court: Since I have indicated my method of procedure, I am going to allow them to make a record on that, and after a full cross-examination I will be in a position to rule. Proceed.

Mr. Wittschen: Note an exception.

Mr. Marrin: Read the question. [559]

(Question repeated by the reporter.)

The Court: Do you understand the question?

A. I believe I do, your Honor. It cannot be removed with safety unless the ground is self-

(Testimony of Lewis Michael Larson.)

supporting. It is one of degree. In some cases it would cause an immediate filling in, in other cases it might sustain itself for a very limited time, but it is an unwise risk to take.

Mr. Wittschen: Just a moment, I am going to move that the answer go out as being entirely immaterial, not entirely responsive to the question, and not proving any issue.

The Court: The objection will be overruled.

Mr. Wittschen: Exception.

Mr. Marrin: Q. Were there any other provisions in these specifications, Mr. Larson, upon which you relied in determining the method of procedure which you followed in constructing these tunnels?

Mr. Wittschen: The same objection to that as to a similar previous question, and the further objection that it is entirely immaterial what procedure he adopted. His principal agreed to build the tunnel, and to finish it, and the procedure that they followed was up to them.

The Court: I will allow him to answer.

Mr. Wittschen: Exception.

A. Will you kindly read that question again?

The Court: Read the question.

(Question repeated by the reporter.)

A. May I couple that, your Honor, with a conclusion?

The Court: You will have to answer the question.

Mr. Marrin: Q. Were there any other provisions of the specifications?

(Testimony of Lewis Michael Larson.)

A. Not that I recall at this time.

Q. Very well, that answers it. Mr. Larson, did you consider the [560] fact that the specifications provided for a construction of 200 feet of Type B and 5600 of Type A?

Mr. Wittschen: Objected to as asking the witness to construe the specifications which are for the Court. That provision was just read, and it reserves the right of the District Engineer to have it all Class B if he so desired.

The Court: Read the question.

(Question repeated by the reporter.)

Mr. Wittschen: My objection is that there is nothing in the specifications to warrant his conclusion. He just read into the record that the District Engineer could order it all Type A or all Type B.

The Court: He may answer the question.

Mr. Wittschen: Exception.

The Court: Do you understand the question?

A. I understand the question, yes. My conclusion was that the thought in the Engineer's mind would be that there would be a very limited amount of Type B.

Mr. Wittschen: Is he to interpret the Engineer's mind?

The Court: You cannot interpret the Engineer's mind. You would have some capacity if you could do that.

Mr. Wittschen: The answer may go out, I take it?

The Court: It may go out.

(Testimony of Lewis Michael Larson.)

A. I will have to admit that it did help confirm the conclusion in my mind that there would be a limited amount.

Mr. Wittschen: I ask that the volunteer statement go out.

The Court: It may go out. Read the question.

(Question repeated by the reporter.)

Mr. Wittschen: That is assuming something not in evidence, it did not so contemplate.

The Court: I am going to allow the witness to answer it if he can. [561]

Mr. Wittschen: Exception.

A. It did influence me in believing that there would be a limited amount, if that answers the intent of the question.

The Court: What do you mean by that?

A. A limited amount of the Type B which is the heavier type.

Q. What do you base that on?

A. I base it not only on the specifications, on the geological report—I had to combine all of those things to form the conclusion.

The Court: I think the question and answer may go out. I have tried to clear the matter up and cannot do so. You may reframe the question.

Mr. Marrin: I will withdraw the question.

The Court: We will take an adjournment now until tomorrow morning at ten o'clock.

(An adjournment was here taken until tomorrow, Thursday, April 14, 1938, at ten o'clock a. m.) [562]

Thursday, April 14, 1938;

10:00 O'Clock A. M.

Mr. Wittschen: Before the witness is called, may I have one technical matter corrected and have an understanding with the other side? I hurriedly read through a small portion of the record of yesterday's proceedings, and I know it is inevitable that transcribing and typographical errors will take place, but I have noticed several, and I think this stipulation is agreeable to the other side: that we may go through the record at our leisure, make certain corrections that we agree upon, and notify the Court; and, in the event we fail to agree, the Court can straighten out any errors.

On page 111, there is one matter that, from my viewpoint, is serious: I think your Honor will recall that I objected most vigorously to the introduction of the geological report, and your Honor recollects that I took an exception. No exception has been noted; and I would like page 111, at the place that that geological report was admitted in evidence, to note that the defendant took an exception to the Court's ruling.

The Court: The record will so show.

Mr. Wittschen: Would your Honor so order?

The Court: Yes.

Mr. Wittschen: There will be others. I have not had a chance to go further.

Mr. Marrin: If the Court please, preliminarily, the plaintiff has alleged that it was the holder of a contractor's license issued by the Contractors' State License Bureau of this state, at the time the contract was entered into and during all the time that it was ours; and I understand that the attorneys for the defendant are willing to stipulate to that.

Mr. Tinning: Yes, we will stipulate that you were duly licensed at all times during this contract.

[563]

Mr. Marrin: Yes. There is one other matter, your Honor, which I should like to refer to.

Mr. Tinning: May I say the reason for the stipulation is that the original license was lost in moving around, and that is why it is not produced?

Mr. Marrin: That is the reason. They were posted in the job office and became lost. In looking over the transcript of yesterday, I see the following statement which was made by the Court to the witness; and the witness's reply to the question of the Court is this—it is in connection with the discussion on timbering specifications:

“Q. That is to say the engineer was to determine that?

A. Yes, the engineer is to determine that.

Q. He had the final word, under the plans and specifications?

A. Yes; that is correct.”

At this time, we want to point out to your Honor that we do not agree with any statement that the

engineer had any right to interpret or change the contract, or that he had any arbitrary power under the contract, while the contract——

The Court (Interrupting): Yes; the Court did not intend to infer that he did.

Mr. Marrin: Well, I just wanted our position to be clear.

The Court: The only thing I was referring to—the thing in my mind was that it was stated by counsel on either one side or the other that he was, and the plans and specifications so indicated—the plans, rather. That was all I had in mind.

Mr. Wittschen: The specifications indicate he could determine whether or not timbering would be left in or taken out.

Mr. Marrin: There will be a great deal of testimony, later on, with respect to the power of the engineer, at which time we will [564] want to argue the matter; and I simply want it understood we don't agree that that is the situation, at this time, so you would not be misled.

Mr. Wittschen: Well, Mr. Marrin, I think each of us is apprised as to how far the engineer may go; but the Court's question is not directed to determining matters of policy by the engineer, but merely, on that item of timbering, that there was a clause in there that gave him discretion as to whether the timber could remain in or be taken out; and the clause will have to speak for itself.

Mr. Marrin: Yes; that is correct. Also, at page 172 of the transcript, I at first made a misstatement to this effect: .

“No, the plans do not quite provide that. They require the timbering in unless the District Engineer, by order, requires them to be taken out, or permits them to remain in.”

I corrected that statement, because it is not true. The plans provide, as Mr. Wittschen stated, that the timbering shall be removed unless the engineer permits them to remain in. The reporter did not get that correction. I simply want to clear that up.

Mr. Wittschen: I think probably I have not had the opportunity, as you have had, to read all of the transcript; and I have suggested, earlier, if there are any misstatements, they can be taken care of.

The Court: I think I am aware of the position of both sides. I don't think there will be any difficulty about agreeing on anything—wherever there may be a dispute in relation to it, if there is, you will have an opportunity to call witnesses to straighten it out, if there is any question about it.

Mr. Wittschen: We shall not be technical about it. [565]

LEWIS MICHAEL LARSON,

recalled for the *defendant*;

Direct Examination (Continued)

Mr. Marrin: Q. Mr. Larson, did you complete an estimate on the cost of constructing the tunnels which are described in the contract between the plaintiff and the defendant, which has been introduced in evidence here? A. Yes, I did.

Q. Before completing that estimate, did you form an opinion as to the character of the ground through which those tunnels would be constructed?

A. I did.

Q. What was that opinion?

Mr. Wittschen: Objected to as incompetent, irrelevant and immaterial, calling for an opinion and conclusion of the witness upon a matter that is not binding upon the defendant, and on the further ground that the defendant is not bound by the opinion or conclusion of any witness, but the contract and specifications must speak for themselves.

Mr. Marrin: If the Court please, there was a little confusion at the end of the day yesterday. We are offering this testimony to prove, not what the plans and specifications mean, or to determine them, but to prove a fact. That fact is the reliance of this plaintiff upon those representations. Whether or not the plaintiff was justified in placing that faith and reliance upon them will, of course, in the end be for the Court; but we want to prove, through this witness, and offer to prove through him, the fact of such reliance.

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: The District, the defendant in this case, is not bound by the opinion and conclusion of any witness.

Mr. Marrin: That is not the point, your Honor,—as to whether they are bound. There is no attempt being made here to change the specifications or the contract. The only purpose of this testimony [566] is to show the reliance upon it,—which is a matter of fact; and which we feel we have a right to prove.

Mr. Wittschen: I would like to add to my objection: that it is a self-serving conclusion.

The Court: I will allow it, subject to the same ruling: subject to a motion to strike and over the objection of counsel.

Mr. Wittschen: Will you note an exception, please?

The Court: Note an exception.

Mr. Marrin: Will you read the question, please, Mr. Reporter?

(Pending question read by the reporter.)

The Witness: A. The opinion was that the major portion of both tunnels would be in self-supporting ground.

Mr. Marrin: Q. Upon what was that opinion based?

Mr. Wittschen: I make the same objection to that question as was made to the preceding question, and on all the grounds.

The Court: Same ruling.

Mr. Wittschen: Note an exception.

(Testimony of Lewis Michael Larson.)

The Witness: A. It was based on a study of the geological report, on a study of the specifications and of the plans, and upon an inspection of the physical features, by myself.

Mr. Marrin: Q. What provision of the specifications?

Mr. Wittschen: We object to that on all the grounds previously stated.

The Court: Same ruling.

Mr. Wittschen: Note an exception.

The Witness: A. On the provision of the specifications relating, to my understanding, that the timbering would have to be removed unless permission of the engineer was granted to allow it to remain in.

Mr. Marrin: Q. And what provision of the plans?

Mr. Wittschen: Same objection on all grounds stated. [567]

The Court: Same ruling.

Mr. Wittschen: Note an exception.

The Witness: A. That the plans indicate a wall, that we term a "batter wall," that led me to conclude that the ground would be offering no inordinate pressure to the side walls; that there was no plan of timbering offered, which is customary, I think, without any exception, in all the tunnels that I have estimated. When timber is to be left in, it is customary to offer a plan showing how the timbers should be left in.

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: I ask that the opinion and conclusion of the witness, as to what is generally done in all tunnels, be stricken.

The Court: What is generally done in all tunnels——

Mr. Marrin: I think, your Honor, that should remain in; the witness is qualified as an expert; he is entitled to rely upon his previous experience, showing what is usually present where the timbering is to be left in the tunnel.

Mr. Wittschen: It was a voluntary statement.

The Court: After all, it will finally be determined, I take it, by the Court, after we have a complete picture. I will allow the record to stand, keeping in mind, as I have stated, it is going in, subject to a motion to strike, over the objection of counsel.

Mr. Wittschen: Exception.

Mr. Marrin: Q. Before completing your estimate, Mr. Larson, did you decide the method of procedure that you would follow, in excavating these tunnels? A. I did.

Q. Will you describe that method?

A. I had planned to go in, on each of the two tunnels, from the westerly side,—westerly end,—with 11 drifts for a distance of 40 feet; on the easterly portals, at each end, with 11 drifts in for a distance of 20 feet.

Mr. Tinning: Q. We cannot hear you, Mr. Larson. I think you started by saying there were 11 drifts?

(Testimony of Lewis Michael Larson.)

A. 11 drifts were planned [568] for the west end, to penetrate the tunnels for a distance of 40 feet; that would apply to each of the two west portals. The east portals, it was planned to drive 11 drifts to complete the outer excavation for a distance of 20 feet,—that is, the east portals, with these drifts. They are perimeter drifts. They are drifts that are driven in the outer excavated section; and timber to be put in,—planned to go in for 720 feet, by wall plate drifts. Should I explain the wall plate, or is it not a proper time?

Mr. Marrin: Q. I will ask you to describe that shortly.

A. And for the remainder of the distance, I had planned to use what I shall term the full face method,—putting up temporary timbers, removing them when the concrete was placed.

Q. From which end were the wall plate drifts; from which portals—

A. From the west end, adjoining the full drift sections.

Q. From which end did you plan to construct all of these drifts?

A. From the west end, with the exception of the 20 feet in the east end.

Q. I show you here a drawing marked "Excavation and Timbering." Will you state what that is?

A. That drawing shows three methods that I had planned to pursue in the driving of the tunnel; and it shows, at the ends,—east and west ends,—where it was contemplated to leave the timbers in.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: I offer that in evidence.

(The drawing was marked "Plaintiff's Exhibit No. 27.")

[Set forth in the Book of Exhibits at page 261.]

Mr. Marrin: Q. Mr. Larson, will you just explain briefly to the Court the methods that you proposed to use and where they occur in the tunnel?

A. Yes.

Mr. Tinning: Yesterday, when Mr. Larson was testifying to some diagram, he was saying "This"; and I am sure the record won't show it.

Mr. Marrin: Yes; we will have to clear that up. We have four [569] wooden models, your Honor, to illustrate this witness's testimony, and I would like to get them.

The Court: We will take a few minutes' recess while you are placing them.

(Short Recess) [570]

Mr. Marrin: I would like to have marked for identification at this time, if your Honor please, this wooden model which I will mark with a "1".

(The model was marked "Plaintiff's Exhibit 28 for identification.")

I would like to offer for identification the wooden model which I will mark with a "2".

(The model was marked "Plaintiff's Exhibit 29 for identification.")

I would like to have marked this model No. 3 as Plaintiff's Exhibit 30 for identification.

(Testimony of Lewis Michael Larson.)

(The model was marked "Plaintiff's Exhibit 30 for identification.")

I would like to have the model which is marked No. 4 marked Plaintiff's Exhibit 31 for identification.

(The model was marked "Plaintiff's Exhibit 31 for identification.")

These models, if your Honor please, were prepared for the purpose of demonstrating the methods used in the actual tunnel construction, with the exception of this model which has been marked "Plaintiff's Exhibit 29 for identification," which was made to demonstrate the method of full face excavation which was contemplated but which was not used, and they are as accurate representations of the method used as we could produce from our records.

Now, for that purpose, if there is no objection by defendant's counsel, to their being placed in evidence, I would like to offer them in evidence for that purpose.

Mr. Tinning: My understanding, Mr. Marrin, is that they are accurate representations of methods that you proposed to use [571] or did use, and drawn to some scale in proportion to the plans of the tunnel, but that the actual timbers that are set in these models are simply demonstrative, and they do not purport to represent particular locations of any timbers that were actually installed in the tunnel?

Mr. Marrin: That is correct.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: We have no objection, on that understanding, to your introducing them as exhibits to demonstrate the method, but not for the purpose of determining the dimensions or actual positions of particular timbers that might have been installed in the tunnel.

Mr. Marrin: We will offer them in evidence then as Plaintiff's Exhibits 28, 29, 30 and 31.

(The models were marked, respectively, Plaintiff's Exhibits 28, 29, 30, and 31, in evidence.)

Q. Mr. Larson, referring to Plaintiff's Exhibit 27, which is a chart, and to plaintiff's Exhibit 28, and to Plaintiff's Exhibit 29, will you explain to the Court from those the methods of excavation which you planned on using at the time you made your estimate?

A. Yes. This illustrates the drift method referred to.

Q. When you say "this" you are referring to the section AA on Exhibit 27?

A. This illustrates two lower drifts; they were to be driven in first to a certain distance, which I will elucidate more fully on the other model, to be followed then by the two drifts immediately above, and then two drifts above them, and continuing so until we reached the top drift, which completes the outer circle.

Q. Now, pointing to the plan of the tunnels, will you point out where it was contemplated by you that that method specified in Section AA would be used?

(Testimony of Lewis Michael Larson.)

A. 40 feet on this end of the two tunnels.

Mr. Tinning: Does that indicate the west end, for the purpose [572] of the record?

Mr. Marrin: Q. Does that indicate the west end?

A. This indicates the west end and this indicates the east end, 20 feet on the east end, or the upgrade end; from that position of 40 feet which is not definitely illustrated here, carried on to the top of these darker lines showing a contemplated wall plate section, which is this section here.

Q. In referring to the dark lines the witness is referring to the west end of the plan as shown on Plaintiff's Exhibit 27, and you are referring now to Section BB as shown in that exhibit?

A. Yes. In this it was planned to excavate this drift marked No. 1 on each side first, placing what we term a wall plate in there, which is a heavy stick of timber, from which we would construct as we progressively advanced with our excavation the arch section of the timbers to support the ground above. When this was excavated to a certain depth, probably 20 or 40 feet, and other wall plates are about ready to be placed in there, or, rather, I should say when it was advanced to the point where it was safe for men to work in this section marked 2-2, on each side, a crew was to be put in there and the muck from these drifts was to be dropped down into this lower drift; the reason for mentioning the safety of the men working below was this, as these two were

(Testimony of Lewis Michael Larson.)

advanced in about the same stage of progress, this final drift, known as the top drift, would be the one that would be excavated, and the permanent timbers put in, forming the arch and protecting the crews below. The next move was to make—these operations were to be carried on forward progressively in the steps I illustrated. We then go along and shoot the core—this section in here is known as the core, not enumerated by numerals 1, 2, 3, and as that core was being excavated this wall plate that I mentioned in the wall plate drift would overhang the excavation and posts would be progressively [573] placed under the overhung portion of the wall plate to give support to the timbers above as the earth was removed.

Q. How was that earth removed?

A. That earth was planned to be removed with power equipment, either air or electric shovels. Dropping back again to AA, it was planned to remove this core too by a power shovel, and after having completed the circle—I might mention that this was planned to be in advance of the concrete lining. This one marked CC—

Q. The witness is referring to Exhibit 27.

A. Of Exhibit 27—it was planned from the point where these wall plate drifts would end to carry that method through the entire length of the tunnel; that is what is termed the "Full face method."

(Testimony of Lewis Michael Larson.)

Q. The wall plating would end at the place indicated in Exhibit 27 where the cross hatching or shaded portion of the tunnel stops?

A. Correct, and where the unshaded portions are illustrated there the full face method was contemplated. In the full face method it was contemplated to put temporary timbers in to protect the workmen from falling rock, from dropping onto the workmen, but later on to be removed in advance of the concrete lining. The advantage in that lies that this section could have been made smaller, because the timber being removed, the timber could have been removed on the inside of the section to be lined by concrete, and being removed in advance it would reduce the section of concrete lining that we would have to put in there by at least one foot per tunnel foot, that is, one foot in width over the circle, a big circle of the tunnel from sub-grade to sub-grade, for the full length where this method was used.

Q. Now, referring to Section AA as shown on the plan, did you plan to leave the timber in that section?

A. We planned to leave the timber in this section known as Section AA, and in BB section. [574]

Q. You did not plan to leave the timber in the section CC?

A. Only the lagging.

Q. Now, Mr. Larson, referring to Plaintiff's Exhibit No. 28, will you point out to the Court just how the excavation was carried on in these drifts,

(Testimony of Lewis Michael Larson.)

and as you go through will you explain what a wall plate is, and what segments are and what spiling and lagging is, so that the Court will understand from now on what those terms mean?

A. Yes. This is what we term the lower drift. If the ground conditions permit we make an excavation in a specified distance, which in my estimate I thought would be five feet in the spacing of those timbers, then the posts are put up. These are the posts and this is the cap put over the posts, and on the top of that we would put what we term lagging. Lagging is illustrated on this side. It is timber laid from set to set, or possibly covering two sets, depending on the ground conditions, and the lagging meets each other on the end; there is no over-lap; I mention that because there is a difference in that and spiling. If ground conditions are bad, instead of making your excavation first and putting your lagging in, you have to shove your spiling, either by what we term the method of advancing—the men would excavate a little portion ahead and then shove the spiling up, and excavate a little more and shove the spiling; that is known as advancing spiling; that is in ground fragile, easily broken, but not running, not particularly dangerous. Where the ground cannot be excavated at all until you have offered some support to it we have the same method of spiling. We drive it with rams into position and form a complete coverage to the men, often times both on the sides and the top, and then carefully remove that.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: I would like to offer at this time in connection with this testimony for illustrative purposes this poster as Plaintiff's Exhibit 32. [575]

Mr. Tinning: As I understand the offer, so that the record will be clear, this is a demonstrative diagram which you propose to use for the purpose of explaining the witness' testimony with respect to spiling or other forms of timbering, and it is not intended to represent any particular timber or any particular section in the tunnel, but demonstrates the method which he said he was proposing to use when he was making these estimates.

Mr. Marrin: That is correct.

(The poster was marked "Plaintiff's Exhibit 32.")

Q. Referring to Plaintiff's Exhibit 28, is any spiling shown on that exhibit?

A. Yes, spiling is shown on the arch, here, and was used throughout without exception, as I recall it now without any exception on the arch; on the sides sometimes the ground would admit of lagging but sometimes it was necessary to have advanced spiling and sometimes it was necessary to drive spiling.

The Court: Q. What were the dimensions of that timber?

A. The dimensions of the timber was 12 by 12, that is, the posts and caps were 12 by 12, and the lagging in most instances was 2 by 10 or 2 by 12, and the spiling generally 3 by 6 or 3 by 8.

Mr. Tinning: Might I interrupt, to save time? Mr. Larson stated without exception spiling was

(Testimony of Lewis Michael Larson.)

used. Do you refer to the area shown in the first model as having the timbering in the tunnel?

A. No, I am merely referring to this model.

Q. Going underground? A. Yes.

Mr. Marrin: Q. For what distance was that?

A. That was planned for 40 feet; that was the plan on each of the two tunnels on the west end and each of the two tunnels on the east end, a distance of 20 feet. [576]

Q. Further referring to the spiling, and referring to Plaintiff's Exhibit 32, will you explain from that the driving of this spiling, taking the operations in sequence, starting with the drawing on there, No. 1? A. Yes. This illustrates—

The Court: Pointing to No. 1?

A. Pointing to No. 1, illustrates the breast boarding, as we were presumed to have a liquid or a moving mass of material that threatens to come into the drift in advance of the time that it is wanted to come in. Now, this illustrates the way it is being supported in advance of the last set. This, by the way, is a set, this shows the posts and the caps that form the set, and the spiling that forms the side, the spiling that forms the roof, and the breast-boarding that protects the material from coming into the drift. Now, the first stage in wanting to make further progress to reach the position shown here by the dotted line would be a condition where driving has to be done instead of, as we term it, advancing. Spiling has to be driven—have you

(Testimony of Lewis Michael Larson.)

anything to illustrate a ram, any picture—I suggest that would be clearer.

Q. What is the difference between driving and advancing spiling?

A. In driving spiling you have to drive it in by forcible means from the rear. In advancing it sometimes you can tap it in with a light hammer, as the excavation is advancing, that is, progressively tapping and progressively moving in with your spiling. That is known as the advance system. Where you cannot do that at all but where you have to drive in in advance, as I explained a little earlier, it is known as driving spiling.

Mr. Marrin: In order that this may be clear to the Court, I would like to offer at this time, simply for the purpose of illustrating the ram, and for no other purpose, a photograph, as Plaintiff's Exhibit 33.

(The photograph was marked "Plaintiff's Exhibit 33.") [577]

Q. Will you explain to the Court, Mr. Larson, from that, what that picture illustrates?

A. This illustrates the ram by which the spiling is driven. You will note that it is suspended on a rope, so the men would not have to carry it, and it will swing forward and back without any appreciable lowering or raising; by being protected in that manner against lowering or raising, it gives a man on the forward end an opportunity of directing the point of driving; that is, he can head the spiling in—

(Testimony of Lewis Michael Larson.)

Q. In order to do that do you have to excavate for it?

A. This is back in the drift. I will illustrate here. The men who are driving that, if they are going to drive this one, are standing back there.

Q. The witness is pointing to Fig. 3 on Exhibit 32.

A. The men are always standing in an excavated drift, and these men are standing in an excavated drift and driving spiling.

The Court: Q. What do they drive that with?

A. They are driving it with this ram. It is like a big hammer, only it is of considerable weight and when it is projected forward there is a force applied by the men on these handles, it is like a pile driver hammer, in a measure, only being driven in a horizontal position.

Mr. Marrin: Will you proceed with your explanation of Exhibit 32?

A. We will assume that we are going to make a further advance of any definite number of feet, let us say 4 feet. We will take a piece of spiling that is longer than that by two and a half to three feet.

The Court: For the purpose of the record you had better note that.

Mr. Marrin: The witness is referring to illustration No. 1 on Exhibit 32. [578]

A. A piece of spiling is entered underneath the cap of the set next back of the forward set that has

(Testimony of Lewis Michael Larson.)

been placed and over the cap of the forward set; the spiling is driven by the ram until it passes this cap, in advance of the cap of the set back of the forward set; in advance of the time the spiling passes the cap of the set next to the forward one a block is put in above that spiling illustrated by sketch 3 of Exhibit 32. That is known as the tailing block. That prevents the spiling from dropping at the forward end and gives a general direction to the spiling as it is being driven. This Sketch No. 2 of Exhibit 32 illustrates the spiling having been driven over the top of the drift. This illustrates only one spiling—there may be several of them; there would be enough over the top of the drift to form a roof of the section that is to be excavated; then what we term side spiling is being driven, and in a very similar manner. This sketch which is blank—No. 4 we will term it—illustrates a similar condition.

Q. I will mark that No. 4.

A. These blocks in here that I am pointing to that rest against the post of the forward set—I should say the set is comprised generally of two posts and a cap. These blocks are placed in there in the position shown—

Q. The witness is referring to No. 4 on Exhibit 32.

A. (Continuing) —to hold a block or a piece of wood away from the post of the forward set, and the spiling is driven from that position so that the next spiling can be entered between the post and the

(Testimony of Lewis Michael Larson.)

spiling that has already been driven. In each case the spiling is fanned to give a greater dimension to the drift than the neat lines of the drift; the purpose of that is always to permit of other spiling being driven in between the outer spiling and the posts; this new spiling, in turn, was driven in starting between the old spiling and the post, but fanned out as the previous spiling [579] was driven. That driving of spiling on the outside of the posts, on one or both sidess, is done when the ground is unstable and won't stand without a protecting shield being driven in in advance of removal of the earth.

Q. Would you use that spiling in self-supporting ground, Mr. Larson?

A. No, indeed not, it is not necessary.

Q. Referring to illustration No. 1 of Plaintiff's Exhibit 32, do I understand you that illustrates the first set in the advance of a drift which had to be driven by using spiling and breast boards?

A. That is correct.

Q. Referring to Illustration No. 2 of Plaintiff's Exhibit 32, does that illustrate the next step which is followed when a drift is driven in that manner?

A. Yes, that illustrates the top spiling having been driven and the side spiling having been begun and the breastboarding having been begun.

Q. This one, for the purpose of the record, does that indicate the commencement of the breastboarding for the advance drift? A. It does.

(Testimony of Lewis Michael Larson.)

Q. With that complete these breastboards will extend down to the bottom of the drift?

A. That is correct; this being added as this earth is excavated below the other breastboard of the muck that is left in the drift; when that is excavated far enough down to permit another breastboard being placed below the one above then another breastboard is added and that is continued until you reach the point at the bottom of the drift, or as far down as the condition of the material that you are in will demand; sometimes it is not so liquid as it is at other times, and sometimes you can stop your breastboarding in half the distance.

Q. The purpose of placing that breastboarding in there is to prevent the unstable material from coming into the drift from the [580] cut before you are ready to take it out?

A. That is true; if it is permitted to run and a cavity forms above, then the open area may come down and break the spiling already driven and catch men that may be working underneath it.

Q. These breastboards, as they are placed, are supported by a stull?

A. Yes, supported in position by a stull carried from the breastboard back to the cap or the posts of the set, against the face, or sometimes carried to the set back from the forward set.

Q. That term "stull" is a new term. A stull, as you use it in tunnel parlance or language means a brace, does it not?

(Testimony of Lewis Michael Larson.)

A. That is what it means, exactly.

Q. Then as you proceed to advance your spiling on the side and place the breastboards in this position—I am now referring to Illustration No. 2, you brace your timber to this post or cap and then remove the lower breastboard and take out a certain amount of material: is that correct?

A. That is correct, take this breastboard out and use it for the next breastboard in advance.

Q. Referring to Illustration No. 3 on Plaintiff's Exhibit 32, does that illustrate the completion of this operation which is commenced in No. 1 and No. 2?

A. It does. It shows the completion of the spiling that has been driven over the top, the spiling that has been driven over the back or the sides, and the breastboarding in position. The next step is the facing of the side, itself, which is illustrated here by the dotted lines. This dotted line below on No. 3 sketch that I am referring to indicates what we term the foot block, any block that is placed underneath the post to keep the weight of the material from driving itself down into the ground below.

Q. This dotted line on No. 3 is the commencement, is it not, of the post which is shown here on Plaintiff's Exhibit No. 28, to [581] which I am pointing, the dotted line, here?

A. Yes, that shows that post of the set or that may be any post.

(Testimony of Lewis Michâel Larson.)

Q. That is correct, but it shows the commencement of that bracing operation? A. Yes.

Q. Referring to No. 4 on Plaintiff's Exhibit 32, does that illustrate an end view?

A. An end view of the boxed drift showing the spiling having been driven on each side, the spiling above having been driven, and the breast-boarding in, with a stull supporting the previous work, and new spiling having been started for the next advance, and other spiling that has been entered that has not yet been driven. Now, we have what is called fan spiling as against horizontal; in order to reach the corners or the greatest extent in width that is necessary in the driving of spiling, being confined in width at the backward side or the backward end of the spiling, it is necessary that some of the spiling that is being driven should be chamfered to a wedge shape, so that the forward end will fill that space that otherwise would be left open if you were to drive spiling in a fanned position, and that allows then and accomplishes the purpose of closing in the forward extension of the spiling, as well as in the backward end of the spiling, the complete excavated area, or the area to be excavated will have no opportunity for fluid material to come in.

Q. Mr. Larson, referring to Plaintiff's Exhibit No. 28, as I understand your testimony it is the circumferential drift system. Does that illustrate the method that you planned, or the method that was actually used?

(Testimony of Lewis Michael Larson.)

A. This illustrates the method that was actually used. The plan had to be departed from on account of—

Q. (Interrupting) Do not give the reasons right now, but just point out the difference between that and the method that you planned? [582]

Mr. Tinning: Q. You have an exhibit showing the plan he proposed, Mr. Marrin?

Mr. Marrin: Yes.

Mr. Tinning: Could we use that in this testimony?

Mr. Marrin: I believe we could; also point out there were more drifts actually used than planned, so this exhibit will not be confused with his planned method.

Mr. Wittschen: That was his planned method, was it not?

Mr. Marrin: Yes.

Mr. Tinning: That is Exhibit No. 27,—the one showing 11 perimeter drifts, starting at the bottom and running to the crown drift at the top—what he planned to use.

The Witness: Well, the difference being here, in the addition of 2 more drifts; instead of carrying 11 drifts, it was necessary to carry 13. The reason for that—do you wish that now?

Mr. Marrin: Q. You don't need to go into the reason now. This model does not show this separate timbering on top, separate drifts?

A. No. This model, to be complete, should show posts at the meeting point of the segments carried

(Testimony of Lewis Michael Larson.)

around, carried down to this central portion which is known as the core.

Q. Now, Mr. Larson, referring to Plaintiff's Exhibit 27, to Section "B," also referring to Plaintiff's Exhibit 30,—which is one of the wooden models,—will you explain to the Court, by reference to this model, the method of excavation which you contemplated using and which is known as the "wall plate method"—you might just proceed to explain as it is illustrated on Exhibit 30?

A. Model 30, your Honor, illustrates the position of the wall plates, with respect to the subgrade. The subgrade is the bottom of the excavation that is to be made. The wall plate is placed in an elevated position, as shown on Exhibit 27, Section "BB."

[583]

Q. About what is the elevation of that, in this tunnel?

A. In this tunnel, it varies from around 15 feet to 17 feet 6, from the subgrade. The plan contemplated going in with the drift adjacent to the wall plate. After the drift had been advanced a certain distance, the wall plate would be entered to an exact elevation and to an exact alignment. On that wall plate, it was planned to erect permanent segments,—which is illustrated on No. 30,—showing a completed ring. That, however, was a progressive step. First of all, the wall plate would be entered—

The Court: Q. For the purpose of the record, the—define a "wall plate."

(Testimony of Lewis Michael Larson.)

A. A wall plate is a heavy piece of timber, depending in size and weight upon the material that is to be carried—generally, 12 by 12 or 14 by 14. I am speaking of inches, now, in the dimensional timber. It has a length varied for the ability to make an excavation of a certain length. Before entering that wall plate in its position, sometimes the ground is in such condition that you do well if you can get in 20 feet of wall plate; other times, you can get in 40 or more; that is a matter of ground condition. When the ground has been excavated and the segments—these are known as “segments” that form the arch—the timbers that form the arch, to raise the wall plate, are known as “segments.”

Mr. Marrin: Q. For the purpose of the record, Mr. Larson, in explaining the wall plate described on Exhibit 30, you have been pointing to a horizontal piece of timber which is lying in the first drift, on the model; and, when you are referring to “segments,” you are referring to a more or less vertical piece of timber—or timbers, which are resting on the wall plate? You may proceed.

A. When the segments are placed in position, a collar brace is placed between the new segment that has been put in and the segment in the set next adjacent to it; and the purpose of a collar brace is to [584] hold the proper alignment, forward and aft of the segment that is being placed to complete the next ring.

Mr. Wittschen: Q. Will you point to the collar brace?

A. This is it.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Maybe I can explain that. In referring to a "collar brace," the witness is referring to a horizontal piece of timber between the segments; and, on this model, appearing above the wall plate.

The Witness: We will assume, now, the wall plate has been completed, and the segments placed on the wall plate. Those segments we have indicated in our sketch as "Segment A"; and a crew then begins the drift immediately above, which is excavated when the lower or the wall plate drift is advanced far enough to make it safe for workmen. That excavation is carried on, and, as the excavation proceeds, segments are placed on top of the segment that rests on the wall plate. That segment is generally indicated, in our sketch, as "Segment B."

I may state that, while the excavation is going on, on the left-hand side of the tunnel, a similar excavation is going on, on the right-hand side. I am describing only one operation; but each side of the tunnel is duplicated in that operation.

As the segments are placed and the excavation is completed and segments placed in the drift above, the wall plate drift collar braced, the collar braces are placed in that, and such lagging or spiling as might be necessary to prevent the material,—that is, the rock, from above,—falling into the drift. Sometimes it is necessary to drift and spile. Sometimes you can make the excavation without any lagging.

(Testimony of Lewis Michael Larson.)

Then you proceed with crews in the drift that is above this completed drift; that would be the third drift; and the following drift completed; in each case, the material in the drift above is dropped down and left in the drift, or used in the wall plate drift itself; sometimes it is wheeled out, by some means,—either a powered equipment or by hand equipment—and dumped into the main portion of the tunnel, at the face of the core, to be removed later on with powered equipment.

As the drift next to the top is completed and the timbers put on in the same manner,—a collar brace and lagging or spiling, as the case may be—in the manner as described below, on the top wall, is started.

The Court: Q. So I may follow: The core is still in there?

A. The core is always left in until the arch timbers are completed; so, if necessary, you can get support from the core to hold the timbers. Sometimes the order has been changed, and you may have to run your top drift in at the same time that you run your side drift, in order to hold a condition of the ground that is less favorable than the kind of ground which has been timbered by the method that you pursued; in which event, you give more support to the material from the top. That support is carried down onto the core, which is already in at this stage of the game. Then the timbers are placed in there. That is what is known as

(Testimony of Lewis Michael Larson.)

the "cap,"—that is, the top segment. It helps, of course, to form, in most cases, the key piece of timber. That now completes the arch, where it still is a key timber, even when you have to drive the drift first; but it sometimes is not the last piece of timber placed. Sometimes it is one of the first pieces of timber placed; in which event, the drift adjacent to the top drift is generally the drift as last completed, when you have the ground conditions that are unfavorable and you [586] have to drive your top drift first, and then you have to drive that muck out, or remove it by some powered equipment, from the drift, and remove it over the toe of the core, and get your support for the drift, and then crews are placed, to follow up; generally, one crew above the wall plate drift first, followed by another crew in the closing drift, which is adjacent to the top drift and which is spaced sufficiently far apart as to be no danger to the men working below.

Q. I am pointing to this drift which runs along parallel to the wall plate—that is what you refer to as the wall plate drift? A. Yes.

Q. And, ordinarily, that is excavated first, and then your second drift follows along behind, and then the third and fourth and so on?

A. That is correct,—generally carrying an average of 20 to 30 feet in advance of the next.

Q. Before any attempt is made to remove anything, when that system is followed, I believe you

(Testimony of Lewis Michael Larson.)

stated the timbering is completed over in the other wall plate,—a similar wall plate on the other side?

A. Yes.

Q. So that there is a complete arch over the core, supported by the two wall plates, before the core is removed? A. That is correct.

Q. To go to the next step in the operation: After the arch is completely timbered for the core, over the core, then what do you do; do you remove part of the core?

A. Yes. We remove part of the core; and that is conditioned, again, on the kind of ground we have. If the ground is favorable, it means that there is not much weight on the arch timbers. If there is not much weight on the arch timbers, you can shoot out and remove more of the core than you can if you have excessive weight above, for this reason: that the wall plate will suspend a certain distance, and a certain weight, dependent on the strength of those timbers, and the size of your wall plate. [587]

Q. You mean the unsupported wall plate?

A. The unsupported wall plate,—the overhang; the unexcavated portion; it supports the unexcavated portion, which will overhang the excavated portion a certain distance.

Q. In order to make it perfectly clear to the Court, Mr. Larson: if I am correct, this model shows a wall plate extending in that far; it is supported, on the end toward the portal, with these timbers which are called "posts"? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. It is supported on the other end by resting on the ground in the wall plate drift?

A. Generally on blocks and in a definite elevation to the wall plate.

Q. But the blocks are on the ground?

A. Yes.

Q. When you speak of the "unsupported part of the wall plate," you mean, as you excavate the core here, before you can get the additional posts in, there will be a certain section of wall plate between the last post and the place where it is supported by a block in the drift, which will have no support under it?

A. There would be no support, and we have, ordinarily, neither the span—sufficient span or strength or weight above. When the ground is hard above, the weight is minor. When the ground is wet above, the weight makes it very heavy to excavate, and we may have to put another post in. As the core is excavated out, the post is advanced up to the excavated portion, to give support there to the wall plate, and the earth removed. That step is carried on progressively; as the core is removed, new wall plate is entered, new posts put in, and so on,—always, the drift being carried on in advance; the core being the last earth to be removed.

Q. That illustrates the wall plate method?

A. Yes.

Q. The method you intended to use, in the 700 feet—

A. 720 feet.

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: Were you going to show it as it was used? [588]

Mr. Marrin: Yes, Mr. Wittschen. We will show what was actually used, in the following testimony.

The Court: Q. Are you prepared to prove, now, how much of this method was used,—for what distance, if you know?

A. I would have to refer to the records.

The Court: Have you any thought?

Mr. Marrin: I might explain this, your Honor: It was our thought—this does not necessarily have to go in the record—but he was with the company until April 30, 1935, and thereafter did not have charge of any of the driving which went on for a year or so after he left. We may have the accurate information in our records. May we have the full face method explained now?

The Court: Q. What method did you call this?

A. This is the wall plate method.

Mr. Marrin: Q. Mr. Larson, you stated that the other method that you proposed to use was the so-called "full face method,"—which is illustrated by Section "CC" of Plaintiff's Exhibit 27. I would now like to refer you to Plaintiff's Exhibit 29, and ask you to explain the excavation, by the full face method, from that exhibit; and, in connection with that, we have another illustrated drawing, which is merely illustrative of the method, and which I would like to introduce at this point as Plaintiff's Exhibit 34.

(Testimony of Lewis Michael Larson.)

(The drawing was marked "Plaintiff's Exhibit No. 34.")

[Set forth in the Book of Exhibits at page 262.]

Mr. Marrin: For illustrative purposes, I would like to offer in evidence the poster, as Plaintiff's Exhibit 35.

Mr. Tinning: What do you call Exhibit No. 34?

Mr. Marrin: 34 is a sketch illustrating the self-propelled drilling and timbering Jumbo. No. 35 is a poster which illustrates the method of placing concrete and the Jumbo in operation in the tunnel under the full face method. It has no legend on it.

Mr. Tinning: Simply illustrative?

Mr. Marrin: Simply illustrative of that method.

[589]

Mr. Tinning: It is a method Mr. Larson says he was going to use after his 720 feet of wall plate drift was completed?

Mr. Marrin: That is correct.

The Court: Q. Which method, I take it, is the economical method. A. That is correct.

Mr. Marrin: Q. Will you proceed to explain the method which you proposed to use in construction, by the full face method, Mr. Larson? You may refer to any of these exhibits. In referring to them, will you please refer to the number?

A. This first one illustrates, your Honor, the drill carriage.

Mr. Marrin: The witness points to No. 34.

The Witness: A. The drill carriage, in position, showing the drifter on the bar, with relative

(Testimony of Lewis Michael Larson.)

positions of the drill carriage. I will describe the operation of the drill carriage, so as to make it clear, in the later conversation, what is intended.

This drill carriage was planned to have mounted on itself a self-propelling unit.

The Court: Q. Pardon me. That was to be the method used in the tunnel,—the rock tunnel?

A. No; that was used in the section—the one described,—what is known as the “full face method.”

Q. I had particularly in mind the Hetch-Hetchy Bore,—that rock tunnel. Are you familiar with that?

A. I am not familiar with the upper portion of the Hetch-Hetchy; no.

Q. What I had in mind—I was up there at one time, going through there, and they were drilling through that rock; and I saw a sort of carriage. Would you call that a “carriage”?

A. Yes, a drill carriage.

Mr. Marrin: Q. Mr. Larson, you might explain that, by reference to this Plaintiff's Exhibit No. 29,—which is a model of the carriage—just how that operates.

A. It operates on a track, your Honor, and runs into the face, and also runs out. It would [590] have mounted on itself an air unit whereby it can be operated forward and backward, from air supplied from the outside. It would have another unit mounted on itself, which would be raised and low-

(Testimony of Lewis Michael Larson.)

ered. It has a platform on the drill carriage; and, in the position that would be necessary in drilling the next hole, this platform would be in, as illustrated, back in the back; but the method here would be for a reserve supply of storage when the driving is done for the timbers that would be used for putting up the next advance set; and when that would be completed, it would be used for the dynamite for loading the holes. The drill carriage was so designed or planned, and partly completed, on the job; and, when it was in those positions, it could be locked into position. The reason for that: it had to have a width sufficient so, when it was taken up from the face of the tunnel, that it would pass over a shovel,—air, steam or whatever you might wish to term it—a powered unit—so it would be free to slide over, or the shovel would be free to slide under. On this bar, illustrated here, is a circular extension of the drill bar for the purpose of permitting the arch—there is a section from here, up,—from the bottom of the top floor of the drill carriage, where the drifter could be advanced no further because of obstructions. To overcome these obstructions, a circular drill bar was placed, to carry the drifter for drilling the arched section of the face. While I have this chart, I think I should illustrate to his Honor the platform on top.

The platform on top was intended for crews to stand on, in placing the timbers, and for plugging. We speak of “plugging” where rocks that are not

(Testimony of Lewis Michael Larson.)

shot into the clear,—that is, not removed in clearance of the concrete line. It is sometimes necessary to drill holes in the rock,—which we term “plugging”; and put in a small amount of explosive there, and break that off. The purpose [591] of this platform was to make it as reachable as possible to all parts of the tunnel. That, as I explained a little while ago, also was erected on the drifter as well as on the drill carriage.

Q. Will you explain the operation of excavation by this method?

A. This sketch No. 35 illustrates the power shovel in the process of excavating the material that has been shot down in advance of the set adjacent to the face. It illustrates a swinging platform that was intended, after the shot was off—that men, by means of wire rope ladders, would mount this swinging scaffolding on which spiling had been previously placed. After the shot is off, they would mount onto this swinging scaffolding, and comb—what we call “combing the face”—taking the loose rock off; they would comb as much of the face as they could reach, and comb the arch, and they would advance that spiling, as illustrated in the previous sketch. It would be in a sort of cantilever position, supported by the spiling back of it. That would be a protection to the men who were working below; they would spile the arch section,—not close, but sufficient to protect any block of material that might—small blocks, that might fall off, from getting loose. As illustrated here, this spiling is in position.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: The witness is referring to Exhibit 29.

The Witness: A. This illustrates the face to be shot out next—the thought being, in this case, to place all of this timber inside of the concrete lining. These hatched portions indicate the ground, and the timbering is in, and what we term the “outside pay line of concrete,” with a reasonable allowance for what we term “overbreak,”—which is outside and permits room for the spiling that has been placed, the thought being, as the concrete came along, to take out the timber set and leave the spiling in, if it were [592] permissible to leave the spiling in; if not, we could take it out. That would be conditioned on ground condition, again.

Q. And conditioned on the ground being self-supporting? A. Yes, that is the point exactly.

Q. Mr. Larson, after combing the face, what is the next operation?

A. While the face is being combed and the spiling is being placed, this shovel is loading the muck into whatever it happens to be. When the muck has been all removed, then the shovel will back out to a position—a position which is a safe distance, and the drill carriage will propel itself up to the forward position. While the muck is being removed, the drill carriage has been loaded with timber for the next advance set. When the shovel moves back, the drill carriage moves forward. In the advanced position of the drill carriage, illustrated here, the drifter is mounted on the bar.

(Testimony of Lewis Michael Larson.)

Q. A drifter is a drill, is it not?

A. A drifter is a heavy drill. The drill platform lowers to the position illustrated here,—Plaintiff's Exhibit 34. In Exhibit 34, the drilling operation is being done. It will be noted on that Exhibit No. 34 that there is a swinging platform on which the men will stand. The purpose of that swinging platform is that the men can drill to the best advantage, at a certain elevation; if they stand with a drifter at about their waistline, they can operate to better advantage than any other position. As they are driving, the platform with the men with the drill steel, and with the drifter, will be raised to the next point of attack where the holes are next to be drilled, and so on until all the holes have been drilled. When they have been all drilled, the next process will be to blow out the hole. When you drive a hole in a rock, there is always a lot of fine rock that has to be blown out. They will blow that, as the platform is being [593] lowered. When the platform is at the bottom, the powder that has been brought in,—the dynamite and exploder will be mounted on the platform, and the loading process will go on, as the elevation of the platform progresses. When the holes at the top have all been loaded to shoot the face,—there is only one way, and that is to put in each hole that has been drilled a stick of dynamite, put into what they term the bottom of the hole, and ram it into position with a wooden bar; then put in what they term the primer; and the primer is another stick of dynamite that

(Testimony of Lewis Michael Larson.)

has an explosive cap in it; these exploders are numbered from No. "0" up to whatever number might be required; sometimes it is "12"; sometimes as high as "15"; the reason for numbering is: we term them the "no delay,"—those are marked No. "0"; just the instant the power,—the electricity,—is turned on, they explode, and they follow—every one follows at a short interval.

The Court: Q. Does one depend on the other?

A. No; they all depend entirely on the live line that is carried through. The construction of the cap, now, generally,—the fulminator in it,—delays the inception, so it can be absolutely controlled. On No. "0", no delay, the instant electric current hits it, it explodes. The fulminator controls the subsequent rate of those which we term the No. 1 and No. 2 and No. 3, and so on, until your last one has been shot. The purpose of that is to control the break of your ground.

Q. What is the purpose of controlling the break of your ground?

A. The way you want it to break,—whether from the top, the center, or otherwise.

The Court: I see. [594]

It was planned in this instance to break at a point about 3 feet above sub-grade with three sets of what we term "no delay," loaded with "no delay" fulminators; they would break the ground; then there were other holes adjacent to that, and that would enlarge the hole into a sort of inverted wedge shape and thus prevent the scattering of the muck—the

(Testimony of Lewis Michael Larson.)

first holes, the breaker holes, will oftentimes throw the material quite a ways back. That is for the reason that it costs a good deal, both in delay and in money, to clean up the track and open the face; that is a period of delay that we try to avoid as much as possible by confining the muck that is broken as near to the face as possible. To accomplish that, however, after these breaker holes have been shot and the enlargement process goes on, after the first shot next is a breaking into the hole that has already been made; very little scattering of muck occurs.

The Court: It is to control the muck?

A. Yes. Then we began what we term caver shots, that is, a shot that will bring down the lower or back end of the hole, and when it is shot it drops straight down instead of shooting out into the tunnel, and after a certain weight gets onto the lower holes they are known as lifters; they generally lie in a position that would have a tendency to throw the muck out in the tunnel if the load from the shot above were not on it; this is prevented by the muck from the breaker shots putting a heavy enough load onto the lifters when they are shot that they will only raise a disturbance, that is, break the muck and not throw it out into the tunnel. The last shots that are shot are the upper ones, and known as the ring shots, that help form the arch.

Mr. Marrin: In order that the record may be clear, Mr. Larson, you mean by the delay, do you not, only this, all of the shots are [595] discharged with one throw of the switch?

(Testimony of Lewis Michael Larson.)

A. That is correct.

Q. The entire delay is due to the difference in the cap, of the fulminating caps on each of the holes?

A. Yes.

Q. And the delay between one set of holes exploding and the next set of holes is only a second or so?

A. That is correct. The holes are shot and the whole breaking situation is generally accomplished inside of a couple of minutes.

The Court: What you mean by delay there is the whole purpose being to control the material, itself, to get the best possible results from your explosive? A. Correct.

Mr. Marrin: Q. If I may ask you another question, the best results in placing and also the best results in order to break the rock, is it not?

A. Breaking of the rock that can be removed, not an over-break; that is an important matter.

Q. I think, as you explained it, after the holes are placed along the bench above the bottom at the grade of the tunnel—the central portion of the face is blasted first?

A. Yes, first of all the enlargement is made from the V-shaped holes that are first formed.

Q. That is the central portion? A. Yes.

Q. Then that would take out these V-shaped portions in the central part of the face of the tunnel?

A. Yes.

Q. And then following that the next holes are exploded and there being no resistance there because

(Testimony of Lewis Michael Larson.)

the central part has been removed, would tend to throw the rock into that space?

A. Into the space that was accomplished by the first shooting.

Q. Mr. Larson, referring to Plaintiff's Exhibit 34, the entire face would be, the entire diameter of the tunnel would be drilled at that time, would it not?

A. That is correct.

Q. And this dotted line section here which is ahead of the drilling [596] Jumbo would show approximately the amount of rock that would be broken down into the bottom of the tunnel?

A. That is a typical display to indicate it.

Q. Then the next step would be, if I understood you, to run the drilling Jumbo back into the tunnel shown on Plaintiff's Exhibit 35?

A. Might I be permitted to clarify that, I used the term "Drill carriage"—drill carriage and drill Jumbo are synonymous.

Q. And then run the cars up to the face, load it up onto the cars, that which has broken loose at the time of the blast?

A. That is correct.

Q. Then after that is completed run the drill carriage up to the face and repeat the operation?

A. Yes, repeat the operation, as illustrated in this case.

Q. In that system there are no drifts, are there?

A. There are no drifts in that system, not as predicted, the ground being self-supporting.

Q. Now, referring to Plaintiff's Exhibit 29 again,

(Testimony of Lewis Michael Larson.)

is that a typical illustration of the timbering which you intended to use in the full faced method?

A. It is.

Q. There is no lagging contemplated on the side posts, is that correct?

A. There was none contemplated.

Q. A certain amount of spiling or lagging was contemplated over the arch? A. Correct.

Q. What was the purpose of that amount of timbering?

A. That was not a definite amount; it was definite only for the purpose of estimating, but it was a certain spacing which was assumed in order to get the quantity of timber that was necessary, and its purpose in being placed there was to protect the men below from the dropping of large blocks of rock; they would have combed or trimmed off the loose material, but this is not always possible [597] to accomplish; sometimes there are mishaps. These timbers were put in to prevent these mishaps.

Q. This timber which I am pointing to and this post and these segments going from one set over to the other is ordinarily referred to as a set, is it not? A. That is an independent set.

Q. If I understood you correctly it was contemplated that these sets would be removed before the concrete operation?

A. That was the plan.

Q. Now, Mr. Larson, what plan did you contemplate in placing the concrete lining in the tunnels at the time you made your estimates?

(Testimony of Lewis Michael Larson.)

A. I had planned on placing the concrete by the pneumatic system, using a movable steel form mounted on a form carrier as illustrated on this Exhibit 35. This is illustrated by this sketch. This portion, your Honor, shows a completed concrete section.

Q. May it be shown for the purpose of the record that the witness is pointing to the illustration at the lower left-hand corner of Plaintiff's Exhibit 35.

A. The next portion that would be presumed to be of concrete is illustrated by the position of the forms. These are steel forms mounted on a carrier, with jacks in position to raise or lower or space the forms out or in. The position here shown is a car of concrete, assuming the position of a car of concrete to be pulled up over a pneumatic gun; the pneumatic gun is shown below this ramp, that pipe leading out from it along the form carrier support; another pipe illustrated as going up over the top, the plan being to have laterals leading out from these pipes that are shown at an approximately half-elevated position, if the concrete is to be conveyed from there to the side wall, where it would be discharged into what we term elephant trunks—an elephant trunk is a column projecting down from a receptacle through which concrete is [598] dumped from a higher elevation to a lower position. When the side walls have been brought up—I should have stated that this car would be conveyed to its position over the pneumatic gun by a hoist mounted on the

(Testimony of Lewis Michael Larson.)

frame of the form carrier; it would be dumped into the gun, and dropped down and another one brought up, and the process repeated. As the gun was loaded the air under pressure from the outside would be placed into the gun, which would convey the concrete over to the side walls or up over the arch. Assuming the side walls have been completed, to complete the pouring of the arch it was planned to cut the pipe into shorter sections of about 5 feet and when the forward end of the concrete was completed to take off one section after another, as the concrete filled that form, until finally closing up the bulkhead. That pouring then would have been completed. This pipe, then, that formed the top would have been removed entirely off the form. After the concrete had the required period of set the jacks would be released and the forms would be brought down from the concrete and moved into a new position, and the operation would be repeated. That was the plan that was contemplated, but it was all predicated on one thing, that we could remove the core in advance of concreting.

Mr. Marrin: I would like to interrupt and ask you this question. On this illustration on this poster they show the tunnel, do they not, as if you were looking at the side cut in two?

A. Correct, at the center line.

The Court: We will be in recess until two o'clock.

(A recess was here taken until two o'clock p. m.) [599]

Afternoon Session

2:00 O'Clock P. M.

LEWIS MICHAEL LARSON,

Direct Examination (Resumed).

Mr. Marrin: Just before the noon recess your Honor asked Mr. Larson if he could state the number of feet of the wall plate method which had been installed. Have you checked the records on that, Mr. Larson. A. I have.

Q. Can you tell the Court how many feet were actually installed in that tunnel?

Mr. Wittschen: Is this only the part of the tunnel built under his direction, or the whole tunnel?

The Court: I was just asking casually.

Mr. Wittschen: I am not sure.

Mr. Marrin: He is testifying to the whole tunnel.

Mr. Tinning: That is, the whole tunnel that was constructed by the Six Companies?

Mr. Marrin: By the Six Companies.

A. There is a total lineal feet of tunnel of 3065.

The Court: In length?

A. That takes in the two tunnels.

Q. Both sides.

A. A total of 3065 lineal feet.

Q. Of the wall plating method? A. Yes.

Mr. Marrin: Q. How many feet of the drift method. A. 172.

Q. And of the full face method? A. None.

Q. I did not ask you the size of these tunnels, Mr. Larson. Could you tell us the size of the tunnels?

(Testimony of Lewis Michael Larson.)

A. The excavation size, the size that it was necessary to excavate in order to get the timbers in to the right distance to admit of the concrete lining where the timbers were left in approximated about 39 to 40 feet in width, and the height at centers above sub-grade was approximately [600] 36 feet.

Q. Does the size of the tunnel have anything to do with the difficulty of holding the ground?

A. It is very material in adding to the difficulties if the ground is not self-sustaining.

Q. Is the larger tunnel more difficult to hold?

A. Very much more. It increases the difficulties as the size increases.

Q. How far apart did you plan to space the timbers under the various methods that you described this morning?

A. 5 feet in all instances.

Q. Five feet?

A. 5 feet centers between sets, between individual members of the sets, that is, I mean the complete set, 5 feet to the center of the next set.

Q. Referring to Plaintiff's Exhibit No. 29, by that you mean it would be 5 feet between the center of the first segment and the center of the next segment?

A. Yes, and that if carried to completion it would mean 5 feet between every member of the set.

Q. What was the size of the timbers that you planned to use in that set?

A. It was contemplated 12 by 12.

(Testimony of Lewis Michael Larson.)

Q. That would mean the space between timber sets would be 4 feet?

A. Correct, that would be the length of the collar brace.

Q. You started to describe the concrete practice, and I am not sure just exactly where you had gotten, but in connection with that I would like to offer in evidence as Plaintiff's Exhibit 36 this poster which is illustrative of a pneumatic gun for placing concrete in tunnels or other structures.

(The poster was marked "Plaintiff's Exhibit 36.")

And I would like to also offer at this time two photographs, the first of which states that it is a 28-foot section of steel tunnel form of carrier erected at the Berkeley Construction Company prior to delivery to tunnel June 19, 1935, for the purpose [601] at this time of illustrating the testimony of the witness as to what a steel form is.

(The photograph was marked "Plaintiff's Exhibit 37.")

[Set forth in the Book of Exhibits at page 263.]

Mr. Tinning: What number is that, 129?

Mr. Marrin: 129. And photograph No. 130, another view of steel form of carrier, June 19, 1935, for the same purpose.

(The photograph was marked "Plaintiff's Exhibit 38.")

Q. Mr. Larson, will you proceed to describe the method which you planned to use in placing this concrete in the tunnel?

(Testimony of Lewis Michael Larson.)

A. I proposed to use what is known as the Hackley gun, a gun with which I was familiar and had used in the placing of many yards of concrete. It is illustrated by Plaintiff's Exhibit No. 36. This end of the gun, the backward end of the gun, shows a connection between the compressed air from the outside of the tunnel—referring in this particular instance to two tunnels—the hose that connects the air line to the intake or manifold of the gun. The gun is first loaded up, having concrete dropped in as its cover has been tipped back; it then fills a good portion of the body of the gun, the lid is returned to its closed position, and tightened down by this wheel and screw—that operates to tighten it; when it is secured the operator begins to make delivery of air to the intake of the air from the hose on the line on the outside and comes into this manifold; the first valve which is opened is the valve that connects with the long pipe. You will note on this sketch that there is a pipe that enters the longest pipe, there is the pipe that goes to almost the length of the inside of the gun; the purpose of making that delivery is to start moving the concrete in its free end and prevent it banking and plugging. When that concrete is started in this longest pipe and gets in motion through the pipe then the valve that controls the next longest length of [602] pipe is opened and it is carried in that open position, the longest one continuing to flow all the time and as the concrete is pressed forward the

(Testimony of Lewis Michael Larson.)

emptying of the forward end of the gun takes place; the next valve that controls next the longest length of pipe is opened and it carries more of the concrete in front of the longest or main delivery pipe, and when the concrete has gone pretty well out of the gun the fourth and last valve is opened. The pipe in this instance, just going inside of the shell at the bottom of the gun, has a tendency to throw less of the concrete upward. Each one of these valves is worked alternately so as to carry that concrete progressively to the delivery pipe, the longest pipe. When all of the concrete is moved out of that gun the operation is repeated again in the same manner.

Q. The illustration on the left-hand side of Exhibit 36 is simply an end view of the gun?

A. Yes.

Q. Is the concrete expelled from the gun with considerable force?

A. We aim to carry 100 pounds of air to unload the gun and it is a matter of very considerable force; it would be a dangerous force to stand in front of, if you were within a reasonable distance, say 50 or 60 feet or even 100 feet of the gun.

Q. Referring to the illustration on the right-hand side of Plaintiff's Exhibit 36, is this a portion of the pipe leading to the forms?

A. This is the end of the gun proper, and from here on this pipe, and that pipe is generally bent in a sort of "S" position. However, it does not

(Testimony of Lewis Michael Larson.)

mean, necessarily, that it has that particular bend. Sometimes the position of the gun means another additional piece of pipe before the sweep, as we term it, is put on; that is a long curved piece of pipe.

Q. Did you contemplate using that gun in placing the concrete here?

A. The estimate was set up on the use of that gun. [603]

Q. Did you explain the placing of the concrete as shown on Exhibit 35?

A. I was short in one explanation. It can be seen up there—this is on 35—there are some steel stulls that are indicated in this sketch that go on to the spiling and hold the spiling in position by the weight being transmitted to the forms. The purpose of that is to prevent any loose fragments that may possibly drop into the concrete where there may be an objection to its falling into the concrete, the thought being to keep that spiling in that position during the placing of the concrete, and if it should be opposed it could be removed. I think I have explained the rest of it, the delivery through the pipe to the side walls and over the arch, and the moving forward.

Q. About how far back normally from the face of the excavation would that concrete operation be carried on?

A. I had planned a distance all the way from 300 to 350 feet, so as to allow sufficient room be-

(Testimony of Lewis Michael Larson.)

tween the concrete unit and the excavation unit. There are trains working in here, switching cars, that have to be delivered to and taken away from the shovel. There has to be a location whereby the form carrier can be taken back, and when the concrete operation is going on there has to be a little distance in advance of the concrete form to allow the concrete car to be brought up where it can be taken by the hoist rope and carried up to its position. In order to allow sufficient latitude and work room I had planned a place between 300 and 350 feet as the proper distance.

Q. You planned to keep your concrete then 300 or 350 feet behind the excavation?

A. That was the thought.

Q. You spoke about using steel forms, Mr. Larson. Referring to Plaintiff's Exhibits 37 and 38, are those typical of the steel forms that you planned to use?

A. They are typical.

Q. This portion going around here is a steel form—I am pointing to the circumferential part of the picture.

A. Yes. [604]

Q. What is this within the steel form?

A. That is the form carrier that supports the form and these jacks that are illustrated as coming at different angles from the form carrier are the jacks that are used in spreading the form out to the necessary width, elevating the form to the necessary height. The dark interior is a row of track in such forms in order to carry the form forward; it would

(Testimony of Lewis Michael Larson.)

take very little adjustment, but the adjustment can be made, a form can be shoved over by driving stulls against the form or by various methods.

Q. Have you explained how that operates? If you have not, will you do so?

The Court: What do you mean?

Mr. Marrin: I want to bring out the fact that this form is used and that it is jacked up, and then after the concrete sets the jacks are released and it is moved forward and re-set.

A. I brought that out this morning.

Q. What did you do with your estimates after you made them?

A. I made them up on individual sheets and as each sheet was completed I passed it to Orselli.

Q. Who was Mr. Orselli?

A. He was an estimating engineer in the employ of W. A. Bechtel Company, and he was assigned to assist me in making extensions and totaling up my figures to see that they were correct, and in getting the information on material prices that went into the construction, either temporarily or permanently.

Q. After the contract was awarded to the Six Companies of California did you enter its employ?

A. Yes, I did.

Q. What was your position?

A. Superintendent of tunnel work.

Q. What did you do thereafter in commencing the construction work under this contract?

(Testimony of Lewis Michael Larson.)

A. Immediately following the letting of the contract I assembled the necessary equipment and began its [605] installation for the progress of the excavation of the tunnel, and meanwhile collaborated with Mr. Fontaine in the excavation of the approach cut on the west end.

Q. Were any difficulties encountered in excavating that approach cut?

A. We run into unexpected difficulties; we run into one very soft place that apparently had been used at some previous time as the location of a water tank. We found evidence of it in timber that we removed. That made it difficult to find any way of supporting the tunnel and much of that material had to be shoved off by "cats", because the shovel could not get into it.

Q. What do you mean by "cats"?

A. Caterpillar tractors and bulldozers, that is a form of equipment; and in many instances we found that the material had a tendency to run outside of the right of way, the slope being steeper than the material would permit by carrying the open cut through the location of the portal; we had expected, of course, to find a considerable resistance there, because we were removing this drift to which I had referred, and it developed that there was very little of that material outside of the actual location of the drift, which was unfortunate—

The Court: This was on the approach of the tunnel?

(Testimony of Lewis Michael Larson.)

A. This was on the approach of the tunnel.

Q. From which end?

A. From the west end.

Q. That was out in the open?

A. That was out in the open. That was a prospect drift to which I referred yesterday, and in the removal of that we found some resistance, but outside of the drift very little resistance, and the tendency of the material to cave outside of the right-of-way line.

Mr. Marrin: Q. Did these slides delay the excavation of the cut any?

A. Yes; we removed considerable extra quantity of material which has been roughly estimated as 20,000 yards; to remove [606] that much material and having these slides, menaces, obstructions to our progress necessarily increased the period of time and incidentally the cost of the work.

Q. I show you, Mr. Larson, a series of 11 photographs dated from July 7 to August 8, 1934, can you tell us what those show without trying to describe each one? Just describe them generally.

A. They illustrate very graphically pictures of the conditions that were encountered in this approach cut to which I have just referred.

Q. And the slides that occurred there during that time?

A. The slides that occurred there, yes.

Mr. Marrin: I will offer these photographs in evidence.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: How many are there?

Mr. Marrin: There are 12. Haven't you twelve there?

Mr. Tinning: Twelve sheets or twelve photographs?

Mr. Marrin: There are 12 sheets.

(The photographs were marked "Plaintiff's Exhibit 39.")

[Set forth in the Book of Exhibits at page 264.]

Q. When did you commence the excavation of the West Portal Cut?

A. The exact date I have forgotten, but it was sometime in June.

Q. Can you state when you completed the excavation of the West Portal Cut?

A. Approximately the 28th of July we figured getting up to the portal of the future tunnel. [607]

Mr. Marrin: Q. Did you excavate any of the portal sections with the open cut method?

A. I tried to excavate, as an open cut, a section of the tunnel at the west portal. I carried the excavation on for a distance, as I recall it, of about 8 or 10 feet.

Q. Did you stop at that point?

A. I stopped at that point.

Q. Will you explain why?

A. The tendency of the material to run, not only beyond right-of-way lines but to run to the point where it might possibly endanger traffic on the old

(Testimony of Lewis Michael Larson.)

Tunnel Road, and enlarge the amount of material that would be necessary to move, thereby making the operation both dangerous and uneconomical, caused me to stop the excavation of the portal section at this point.

Q. Do you remember about what date you stopped that excavation by the open cut method?

A. As I recall it, it was July 28th.

Q. That was caused by the character of the ground; that ground would not stand under open cut?

A. It would not be economically feasible, and it would be dangerous to traffic.

Q. When did you commence the actual excavation of the tunnel, Mr. Larson?

A. I started the excavation of the tunnel on August 1st.

Q. How long did you continue excavating the tunnels? A. Until about August 10th.

Q. Why did you stop at that time?

A. The subcontractor, K. E. Parker, who was putting up the portal buildings, stated that our operations interfered with his construction of the portal buildings—May I describe the part we played in the portal buildings, along with this?

Q. Well, state the location of the portal buildings.

A. The portal buildings,—including the transition section, which will have to be considered as part of the portal buildings,—were erected at the

•(Testimony of Lewis Michael Larson.)

portal to the tunnel; or, in other words, it adjoined the tunnel.

The Court: Q. This was a subcontractor?

A. Yes. [608]

Mr. Wittschen: I believe it should be brought out it was your subcontractor.

Mr. Marrin: Yes, it was our subcontractor.

The Witness: Yes, our subcontractor.

Mr. Marrin: Q. Was the portal building in the cut?

A. The portal building was in the cut, yes.

Q. At the west end of the tunnel?

A. Yes.

Mr. Tinning: With reference to this subcontracting: the work was also subcontracted on the excavation of the portal building, was it not?

Mr. Marrin: Well, the witness can state that, I think.

Q. Will you state what the situation was with respect to the subcontracting of the excavation on the portal buildings and the work the subcontractor did, up until the time we took the work over on the tunnel end?

A. McKinley and Crowell had subcontracts for excavating the approach cut, and K. E. Parker Company had the subcontracts for erecting the portal building when the cut was completed, with the power unit.

Q. What do you mean by "power unit"?

(Testimony of Lewis Michael Larson.)

A. By Caterpillar tractors, by Bulldozers and power shovels. We realized, at that time, that it would be necessary to push, as rapidly as possible, the construction of the portal buildings; and, in order to expedite this work, realizing the subcontractor was not equipped to travel as rapidly as we would like to have had him do, we proceeded with the excavation of the footings, trenches, to receive the footing concrete for the portal building. We carried that on for 24 hours a day, with all the force that we could put in there, in the way of men and tools. That was done, with a view to expediting this particular work, because, at that stage of the time—or, of the work, it was very apparent there were two very important things to be done: one was to get the [609] portal buildings up, so we could backfill and support the walls that had a tendency to slide; and another one was to get the tunnel far enough underground before the seasonal rains hit us, so we could carry on during the winter, realizing, if we failed in that, we might lose not only the portal building slope, but we might find it impossible to go underground in the condition that we found the ground at the portals.

Q. That was taking over the subcontracting work from—— A. McKinley Crowell.

Q. Yes? A. Yes.

Q. You spoke of the portal building being subcontracted. To whom were the portal buildings subcontracted? A. K. E. Parker Company.

(Testimony of Lewis Michael Larson.)

Q. Six Companies did not take over the work in connection with that?

A. No; they did not.

Q. Can you explain why—Well, before I ask you that, I would like to show you this photograph, and ask you what that represents.

A. That represents the beginning of excavations for the tunnel at the west portal; and it also represents the excavations that I have just spoken of, of the trenches for the footing concrete for the portal buildings.

Mr. Marrin: I will offer that in evidence.

(The photograph was marked "Plaintiff's Exhibit No. 40.")

[Set forth in the Book of Exhibits at page 276.]

Mr. Marrin: Q. Will you explain the conflict between carrying on the commencement of the tunnel work and the completion of the portal building?

Mr. Wittschen: May I have that read?

(Pending question read by the reporter.)

Mr. Marrin: I believe he mentioned that it was held up. I wanted him to explain the reason.

Mr. Wittschen: You are not charging us with that, are you?

Mr. Marrin: I am not charging you with anything, Mr. Wittschen. [610]

Mr. Wittschen: Very well.

The Witness: A. The reason it was held up: K. E. Parker, Subcontractors,—they could not proceed with the speed that we were asking of them. If

(Testimony of Lewis Michael Larson.)

we continued to interfere with their operations, by hauling this muck over the structure that they had to work on, it was very apparent to us that they could not—and, consequently, we suspended the operations, because it was more important for them to get the portal building up than it was for us to start on the tunnel.

Q. How long were the operations, before commencing tunnel construction, suspended for that reason?

A. Until August 23rd. I would like to answer, in connection with that, what we did, on the portal building, to expedite it. I think it ties in properly with this.

Q. Proceed.

A. When the portal foundation concrete was placed and the reinforcing steel sticking out of these footings for the concrete of the walls, we had been fortunate up to that point in guessing that the side walls would stand. Almost immediately after this concrete was poured, a slide came from the north side, over this footing concrete. We cleared that away; and in an effort to still further expedite the construction, we arranged with the District to permit us to use quick-setting cement, and put the cost of the difference to our own account. In addition to this, it became very apparent that some support would have to be given to those side walls of the cut, because men were working immediately below those menacing walls; and it was not only for

(Testimony of Lewis Michael Larson.)

the sake of the men but for the sake of the construction, that it became necessary. Consequently, I placed breastboards along the wall of the cut on each side, and we furnished the Parker Company with the timber and paid them for making shores between the two walls, meeting those breastboards that I had placed against the walls of the cut. The reason we did that, instead [611] of carrying it on ourselves: they had to do the erection of the walls of the portal building, and it would be a conflict; we might place one of the stulls where it would be immediately in their way. In order to concentrate the work in the hands of one party, we paid the Parker Company for doing the erection work and supplied them with the material. He carried that construction across between the walls,—which was quite a considerable distance—approximately about 120 feet. Those shores had to be carried to safeguard the sides of the cut against going in on the portal building. After the portal construction was erected, we induced the Parker people to work with all the force that they could work, in order to expedite the construction of this portal building, the purpose being to get the side walls up and the first floor on above the subgrade, the walls being vertical walls and not having any cantilever or counterfort subsections; so it was not safe to count on, as that was unsupported. It appeared that it would be very important to get the first floor above subgrade placed; also, so the backfilling of the wall could be pushed as rapidly as possible. By getting that back-

(Testimony of Lewis Michael Larson.)

filling done, it would reduce the hazard of this material to fall, even though the slope maintained would be the same; the elevation would be less, and, if it did slide, it would have a flat place to slide against before it reached the portal timbers, instead of coming directly against the portal timbers.

Q. When did you get to the point of recommencing excavation on the tunnels themselves?

A. My recollection is it was on August 23rd, when we resumed operations, and that was on the south tunnel.

Q. All of these dates, which you are speaking about now, refer to 1934?

A. These are all 1934, now.

Q. Will you state, Mr. Larson, what you did in connection with the excavation of the tunnels, from the time you commenced—Was it [612] August 25th, or 28th?

A. August 23rd.

Q. —1934, until you stopped excavating and poured the first concrete?

A. We began, on the south tunnel, on the 23rd day of August, or approximately that; that is my recollection—with the two lower drifts that were indicated this morning. We started in with the purpose there of trying to find what I still believed would be found: self-supporting rock. I proceeded with the lower drifts to the point where it was safe for men to begin excavating for the second drift,—the second drift being the one immediately above the two lower drifts. Those are the lower drifts

(Testimony of Lewis Michael Larson.)

there. There were two; one on each side; one drift here, and one here. These are the drifts (explaining chart to the Court.)

Mr. Marrin: Let the record show the last question related to Exhibit No. 40.

The Witness: The condition of the ground indicated to me that it would be necessary to increase the number of drifts and to shore them and to work a closer spacing of the timber than that which had been contemplated. I had not gone very far until there was a tendency of the hill to try to slip down upon us. We tried to counter that; and I countered it by putting braces from the posts and the cap down to a concrete strut that ran between the walls of the portal building, to find the positive position for the end of our shores.

Q. I show you a drawing which is entitled "Typical West Portal Bracing"; and ask what that illustrates.

A. That illustrates the shoring that I found it necessary to put in to support the structure against the tendency of the hill to come toward the portal building from the line of drive.

Mr. Marrin: I offer that in evidence.

(Drawing marked "Plaintiff's Exhibit No. 41.")

[Set forth in the Book of Exhibits at page 277.]

[613]

Mr. Marrin: Q. Mr. Larson, will you just explain to the Court what you did in bracing the timbers in the drifts?

(Testimony of Lewis Michael Larson.)

A. This line is the east line of the portal building that was first in process of construction, progressively increasing in height. At the time we began this lower drift excavation, it had reached an elevation of about, possibly, 15 feet, or maybe even at 20 feet—I have forgotten the elevation; and the shores, that I mentioned as having been placed against the posts and the cap of the drift, are illustrated here, and brought down to find its support against the portal building footing.

The Court: Q. Was the hill giving way?

A. Yes; it had a tendency to slide this way, and we were driving in this direction. I found this was insufficient, because the weight of this material and this shore in here had a tendency to lift that post up; I had to drop in and put in additional collar braces on the face of the lower drift, and put these extra braces, or longitudinal braces, in to counter against that tendency to run. As that work progressed in the lower drift and reached a point where we could begin on the second drift, I found the same condition prevailing; there was a tendency all the time for the hill to come against the line of drive. I loaded the top drift, to give as much weight as I could give to these timbers, and, by having additional shores over to the portal building, as these different drifts were opened up; and when I came to a point which is about as high as was convenient to have more shores, I put a series of shores from the portal building, and I found, at

(Testimony of Lewis Michael Larson.)

that point, that the shores then had become so long it was necessary to tie them laterally as well as in their vertical supports. I contemplated to run this way and run toward the portal building, and it was so severe that I found it necessary to continue putting in braces to counter that thrust inside the drifts themselves; and, [614] in order to get a full support over the wall tunnel, I placed timbers across that would catch the drift from the right-hand side and the left-hand side, and carried shores, from different points along that timber, to the portal building. Then the shores began to buckle and took a position much like a bow. By the time I had got into the fourth drift—keeping in mind that the lower drift is number one, the next above it is number two, the next number three, and then number four—I found I had not succeeded in stopping the hill. I had counter'd with timbers put in at 4-foot spacing. To keep the spacing from the sides, I found it necessary to put in wall plates.

Q. Had you, at that time, had any wall plates in your plans?

A. No; I had not planned on shores or wall plates; diagonal bracing; only enough to support as was necessary, because I thought it would be very much different kind of ground.

The Court: Q. How long did this condition prevail? A. This condition——

Q. Just on the approach?

(Testimony of Lewis Michael Larson.)

A. Yes. I will bring it up to that point. We got in the first 12 feet, and then No. 4 drift on the south side,—the south tunnel,—and had opened the two lower drifts in the north tunnel, and were just beginning the excavating above the second drift in the north tunnel, when it became so menacing above, I pulled the men out of both tunnels, and I placed additional supports,—put in such additional shores as were possible; and I could see it was coming; and, about ten minutes after I pulled the men out, about 2000 yards came down from over the portal of the tunnel, closing the drifts.

Q. Had you figured on that?

A. Well, I had figured that first slide.

Q. About what date was that first slide? Can you fix the date? [615]

A. This would have to be a guess,—an estimate—About the 15th of September, I would say. I did not keep any date on it. I am just guessing at the time it would have taken to do that much work.

Mr. Wittschen: Q. The 15th of September, 1934?

A. Yes—that is just an estimate; I don't know whether I am within a week of the correct date.

Mr. Marrin: I think that sufficiently explains that. At this point, I would like to offer in evidence, for illustrative purposes, this poster, which is on the easel, in connection with the testimony that is coming up from this witness and others. It shows, Mr. Tinning, for your information, the various

(Testimony of Lewis Michael Larson.)

methods used in excavating, and the places in the tunnel where they were used.

(The poster was marked "Plaintiff's Exhibit No. 42.)

[Set forth in the Book of Exhibits at page 278.]

Mr. Marrin: Q. Mr. Larson, would you proceed and explain the method of excavation which you used in this first part of the tunnel and any difficulties encountered? In doing that, would you refer to any of these exhibits or models which will illustrate your testimony?

A. This, your Honor, marked "A" on Exhibit 42, shows the method used in excavating the first 92 feet; that is, from the point where we began until we reached a distance in 92 feet from the portal building on the south tunnel, and a distance of 110 feet from the portal building on the north tunnel. The same method was used in showing the two lower drifts; two second drifts, third and fourth, and so on—and the top drift; showing also, in a rough way, the stulls that were necessary to hold the segments in their positions.

Q. How did that differ, Mr. Larson, from the method which you had planned to use in the west 40 feet?

A. I had in mind, there, to use a reduced lower drift; I thought it would be necessary to go in only 40 feet; consequently, I would not need to make as large a lower drift. I may say the reason for it is this: this drift work is [616] always more costly

(Testimony of Lewis Michael Larson.)

than any other method that I know of; consequently, leave as little material in the drift as possible; leave as much material in the core—which is what we term “cheap muck.” I had planned to use a total of 11 drifts, to make the circumference, instead of 13, which I was compelled to use on account of the condition of the ground. These segments were planned to be 7 feet, approximately; they were reduced to about 5 foot 3, in order to give strength, and still at the same time to leave room enough for men to work not at too much disadvantage.

Mr. Tinning: Q. Mr. Larson, may we, for the purpose of keeping some measurements here, follow the stations in which these various parts of the construction were carried? For instance, this 92 feet: what station would that be?

A. That would be for the south tunnel; about 112 plus 45.

Mr. Marrin: Q. I want to direct your attention to the longitudinal drawing appearing on Plaintiff's Exhibit 42. By the way, will you, for the benefit of the Court, explain what is meant by an “engineer's station”?

A. An engineer's station is a unit of measurement. The first station is “O”, “1”, “2”,—which indicates 100, 200, 300, and so on.

Q. 100 what? A. Feet.

Q. In other words, there are 100 feet between stations? A. 100 feet between stations.

(Testimony* of Lewis Michael Larson.)

Q. Your first station is No. 1. The distance between No. 1 and No. 2 would be 100 feet?

A. Yes.

The Court: Q. Does that show on that drawing?

Mr. Marrin: The stations are shown here.

Q. Will you point out the stations to the Court?

The Court: For the purpose of the record, I would like to have the witness describe, in his own way, what this chart depicts, [616-1/2] generally.

Mr. Marrin: Q. Can you explain that?

A. I can; I can explain the whole thing, although I was not on the work for the whole period.

Mr. Wittschen: It might be well to show the station starting at the beginning.

Mr. Tinning: 2 1/2 miles down the road. We will stipulate to that.

Mr. Marrin: Will it be stipulated the first station under this contract was located approximately at Keith Avenue and Broadway?

Mr. Tinning: The west end of the project, certainly.

Mr. Marrin: And about 2 1/2 miles from the westerly portal of the tunnel.

The Witness: The westerly portal, the station on the west portal of the north tunnel was 111 plus 42.55, and the west portal of the south tunnel was at Station 111 plus 53.25.

Mr. Marrin: Q. When you say 111 plus 53.25, that means what?

(Testimony of Lewis Michael Larson.)

A. That means 111 stations, of 100 feet in length, from the beginning point of the project, for this contract plus the fraction of a station.

Q. You say 111 plus 53.25 means 111 stations plus 53.25 feet?

A. Feet; correct. The excavation on the south tunnel, I believe I had indicated, stopped at approximately Station 112 plus 45; on the north tunnel, at approximately Station 112 plus 53.

Mr. Wittschen: Q. You would wish to correct that, wouldn't you? You gave it 111, before, plus 53. It is——

A. 111 is the station. 112 is what it should be; that is the stopping point on excavating for the first lining, the portal being at 111 Station.

Mr. Marrin: Q. Will you explain, generally, to the Court, what that diagram represents?

A. Yes. This, Your Honor, represents——

The Court: What diagram? Identifying it, for the record. [617]

The Witness: A. Exhibit 42. The section marked "A" is a cross-section of the method used in the first excavation of the full drift method that has been delimited by the station number. —

Mr. Marrin: Q. How is that shown on the longitudinal section of the tunnel?

A. That is shown by this blue color, by the index "A" indicated in the blue. The next, Section "E", shown—also illustrated by a cross-section, shows a distance of approximately 42 feet in

(Testimony of Lewis Michael Larson.)

the south tunnel, following this first excavation. That would work out—If someone will work out the mathematics for me——

Q. Well, you don't need to be so accurate on the number of feet.

The Court: Well, if you want to do that, we will take a recess for five minutes.

(Recess)

Mr. Marrin: Q. Will you explain what this represents,—this poster?

A. The poster marked "B" represents——

Q. You are referring to Plaintiff's Exhibit 42?

A. Yes, 42, section marked "B" represents the wall plate method as used in that section represented by the "B" here. "C" illustrates the method used in this section of the north tunnel indicated by the mark "C." The "D" represents the section used in the north tunnel indicated by the legend "D." "E" represents a section of the south tunnel, represented by a cross-section indicated by the legend "E." "F" represents the section in the north tunnel and a section in the south tunnel, both indicated by the legend "F,"—a cross-section indicated by the legend "F." "G" represents a section of the north tunnel indicated by the legend and cross-section marked "G." "H" indicates a section of the north tunnel indicated by a cross-section and legend marked "H." "I" indicates a section of the south tunnel, excavated by the method indicated in the

(Testimony of Lewis Michael Larson.)

cross-section also [618] marked "I." "K" indicates a section in both the north and south tunnels near the east portal, indicated by a cross-section with the legend "K."

Q. What does the white portion of the longitudinal section of the tunnel represent?

A. The white portion between the colored portions indicates the part that was not completed by the Six Companies.

Q. Will you point out, in those systems represented on Section 42, what would be known as the "wall plate system"?

Mr. Wittschen: Mr. Marrin, before you leave that, were you going to put the time element in evidence? In other words, during the period of time these various things were done—

Mr. Marrin: That will all be shown in detail by following witnesses, Mr. Wittschen. I had in mind simply giving a general description for the information of the Court as to what this exhibit represents, and thereafter Mr. Larson will testify in detail as to the part he excavated.

The Witness: A. The wall plate method, your Honor, is indicated by the cross-section marked "B", legend "B", the cross-section of the tunnel with the legend "C", the cross-section of the tunnel with the legend "D", and the cross-section of the tunnel with the legends "G", "H" and "K." [619]

Q. Which of those sections there represents the circumferential drift system?

(Testimony of Lewis Michael Larson.)

A. Legend "A".

Q. What do the others represent?

A. The one represented by "E" is a short section that was driven in the south tunnel whereby the excavation was moved from the two outside edges of the tunnel by one vertical drift on each side, the top drift which was in the mud section, and then by what we term the ring, whereby the excavation was shot down into the lower drifts.

Mr. Tinning: Q. What do you mean by the "mud section"?

A. We found mud in the south tunnel.

Q. You are referring to the material?

A. I was referring to the type of material that we encountered.

The Court: Q. You encountered that material at that point?

A. Yes. "F" section represents a method pursued whereby the two lower drifts were advanced a certain distance ahead of the two drifts immediately above. This did not always hold true, for the reason that bad material was encountered in the lower drift, and it was necessary in one or two instances to pass the second drift over the point where the trouble had occurred in the lower drift in order to stop the run of material into the lower drift. In general, the lower drifts were advanced first, the second drift following, and then the ring taken out as one operation, and the core as the last operation. "G" section indicates the removal—

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. Did you describe that as the wall plate system?

A. Yes; I have already described it. The "I" system indicates the removal of material from a lower drift, two lower drifts, with two second drifts above and two thirds above.

Q. And then the ring was taken out?

A. Yes, and then the core.

Q. You have mentioned and pointed out these different diagrams, Mr. Larson, as the wall plate system. Do any of these represent the [620] wall plate system which you contemplated using when you estimated the work?

A. With certain modifications, yes. Type "B" represents approximately the method that I had in mind, with this exception, it was necessary on account of the formation we encountered to drive the top drift along with the two wall plate methods, which varied it from a wall plate; it became necessary to drive this below the wall plate, and support the ground by spiling on one side on the outside of the tunnel by spiling or breastboarding the core and by breastboarding that portion of the drift that lay immediately below the wall plate; therein it differed. Does that answer your question?

Q. Those are simply modifications of that system? A. Modifications of that system.

Q. Will you proceed, Mr. Larson, and explain to the Court the excavation of the first 92 feet in

(Testimony of Lewis Michael Larson.)

the south tunnel and the first 110 feet in the north tunnel?

A. I believe I had reached a point where I had begun the second drift in the north tunnel and had proceeded a certain distance in with the fourth drift in the south tunnel when that slide of material came from the face of the tunnel. It would probably be proper to drop back and state that in the south tunnel, No. 3 drift, I ran into a rather soft mud formation where it was necessary to resort to this method of driving spiling as explained earlier.

The Court: Can you indicate it on the chart?

Mr. Marrin: The location of it?

The Court: Yes.

A. The location of the drift—this is the drift to which I refer.

Mr. Marrin: Where is that, referring to Plaintiff's Exhibit 42?

A. That would be in the "A" section near the west portal.

The Court: I understood that is where it was but I wanted it in the record. [621]

A. About the time that I began driving the two No. 4 drifts I had got the two second drifts well started in the north tunnel, but in the No. 4 drift on the right-hand side of the south tunnel, this mud, soft mud condition continued forcing the driving of spiling and breastboarding to keep the mud from running into the drift; I began to encounter mud

(Testimony of Lewis Michael Larson.)

also in the fourth drift on the north side of the south tunnel, where spiling was driven, but the material was not so soft that the breastboarding was necessary. That mud continued in to the fifth drift and the top drift of this same tunnel, and we would drive the spiling on the outer rim and do just a little breastboarding, because the mud had a tendency to stiffen at the point where it would not actually run in on us, but it carried so much weight that it was necessary to put stulls from the segments down to the core, and we found some difficulty in supporting it in that position because the core contained mud and I had to take in big wide foot blocks, that is lumber with considerable width in it, to keep the weight of the material above from pressing the post down in through the core. On the north tunnel—I will finish with the south tunnel first, however. By the time that I had got the fourth drift started, as I recall it, and the crews had reached a point in the south tunnel where it appeared that we were going to find self-supporting rock, it was a sort of resistance point, and I was looking for it, because the season was becoming so far advanced that the rains might be expected in a very short time, it was important to find that hard place and get the excavation stopped and the concrete in to support that portion of the tunnel. When I found that I stopped the crews in that portion and began the excavation of this fifth and the top drift, and one each of the following drifts, 2, 3, 4,

(Testimony of Lewis Michael Larson.)

5, in the top drift, all the same distance in from the portal, a distance of 92 feet from [622] the portal; I stopped during excavation on the south tunnel and began immediately to prepare for concrete. In the meantime excavation continued in the north tunnel; I was a little disappointed in reaching the distance that would be equivalent to where this firm material had been reached in the south tunnel, and had not found a similar condition in the north tunnel. I carried on to a distance of 110 feet expecting every time I excavated that I would encounter hard material. A point was reached where I could not continue to drift any longer for fear of not being prepared in the north tunnel for concrete by the time I finished the concrete lining of the portal section of the south tunnel, so I stopped at a distance of 110 feet on the lower drift. In the driving of that tunnel the condition was a little bit different. The material was badly broken, but it was not of the muddy and soft running type; it did not require the driving of any spiling, but it did require very careful handling because of the broken nature and the fault that ran through in different sections of the north tunnel, and I found that we had a handicap in getting the necessary help, it was a most dangerous and difficult portion of the tunnel, and the lack of experienced help—we had to employ through the National Labor Agency; the conditions of employment first were to hire ex-service men and then men with families

(Testimony of Lewis Michael Larson.)

without very much regard to whether or not they fit the work; however, we managed to get through it without any mishap. We had one run in the third drift of the north line, third drift on the right; that was the only menace that we had from material that got beyond control, and it did not amount to a great deal, but we did have a difficulty that developed on the left-hand side of the north tunnel. As we proceeded there a fissure opened in the material, itself, at a distance, as I recall now, of about probably 15 feet to the north [623] of the tunnel. I don't know that we have any pictures that illustrate that, but as we proceeded to go in there that fissure became more and more open, a terrific weight came onto our tunnel at that point, requiring me to carry stulls from the segment over to the core to find support against the core to keep the timber from collapsing and the tunnel from going out. That fissure developed to a point where I used it as a chute for broken material for back-filling the building; and when that weight was transmitted by the breakage of that cleavage, of that crevice, throwing the weight of that portion of the hill onto the side of that tunnel, it required quite a little bit of tunnel support to keep the segments from coming in; some came in as much as ten inches, as developed later when I poured the concrete we had to do a lot of trimming. When we reached a point with all drifts 110 feet from the portal the excavation was stopped on that tunnel, too, and we began

(Testimony of Lewis Michael Larson.)

immediately to prepare for concrete. I will drop back now into the south tunnel. In the south tunnel, on account of not being able to hold the excavation with timber without leaving the core in, it was necessary to find some means of concreting leaving the core, because the core was necessary for the support of the structure; and, later on, for the support of the concrete forms, and consequently I erected some wooden forms in the different drifts and covered those wooden forms with metal, which was required to give a smooth surface to the concrete; when the forms were erected and we began concreting—I should say we had reinforcing rings put in there; the method we had thought would be used was the A method, which indicated one line of reinforcing steel on the inner circumference of the lining, and two rows of reinforcing steel were placed, and when the pouring began we poured a distance of five feet six inches in height in each of the two lower drifts [624] by means of buggies; I had a concrete mixer on the outside and we used buggies, concrete buggies, for transporting the concrete into the forms. When that section was poured up to the five-feet six-inch line I proceeded to pour concrete by means of a Hackley gun that has just been described, by passing a pipe over the top of the form at the center. We immediately ran into a difficult situation there, to deflect the concrete down the two side walls and to meet the conditions of the specifications, which were that the concrete must

(Testimony of Lewis Michael Larson.)

not drop more in a vertical distance than six feet, if it were not in an enclosed pipe, and that it must not be moved more than three feet either way from the point of placement. Under the conditions which prevailed it was difficult. The District Engineer saw our problem and permitted us to bulkhead a distance of about 20 feet, which meant that we could move the material farther than we had first feared it would be necessary. Now, in the placing of that concrete, in the deflecting of the concrete we put a baffle box up there to try and split the concrete and try to get it to go both ways, but when we came to deliver through a pipe with 100 pounds of air behind it and then tried to deflect it, the result was our pipes would plug and the stuff would collect and build up over the center line and not find its way down the elephant trunk. We had quite a struggle and finally managed to get the wall up a distance, as I recall it now, of about eight or ten feet beyond the first pour that was made, when it became necessary, by the orders of the District Engineer, to scrape the cement that had spilled from the force of its delivery over the reinforcing bars and had lodged itself on the forms that confined the concrete. My recollection is I built a key wall at that point—by a key wall is meant inserting a piece of wood or other material that will form a sort [625] of sand bar or something similar to that, so that when the next concrete pour is made on top of it there will be no tendency to side slippage. We

(Testimony of Lewis Michael Larson.)

finally managed to get the wall poured up to the point where the engineer permitted us to do it from the top and fill it from the center pipe.

Q. When you say "the engineer," what do you mean?

A. The District Engineer or his representative. I have that in mind. At that time, and prior to that time, we found that considerable trimming of the sets was necessary because the weight of the structure above forced this timber in. I neglected just one thing that may be important to drop back to here; when we reached a point almost to the end of our excavation in the south tunnel several large cracks began to develop on the hill back of where the first slide came, and I realized that from the state the tunnel had been in and the weight of the forces were bearing in on the timbers, they were acting, if another slide came I would lose the whole tunnel. Consequently we got the nearest and the quickest drag line that it was possible to get, built a temporary road from the old tunnel road down over the portals of the new tunnels which were being excavated, brought a "cat" and bulldozer down, and by working 24 hours a day we managed to remove the menacing slide, dragging it as far back as possible with the drag line and bulldozer and cat pushing it from the point where it was a menace. That relieved the weight on the south tunnel, but not sufficiently to prevent the remaining weight shoving our timbers down within the con-

(Testimony of Lewis Michael Larson.)

crete line, and to trim those timbers with reinforcing steel within three inches of them, or more than two inches of them, was very costly, slowed up the progress, but it was necessary to keep the timber outside of the concrete line. After having poured that first 20 feet we put in another bulkhead. I should have said that we began [626] the pouring from the inside, the farthest distance in, that is 72 feet approximately, and that gave a sense of security because it would have a tendency to check any further slide over the most vulnerable section of the tunnel. I then erected a bulkhead in there approximately 20 feet toward the portal, and by using the same method succeeded in pouring the next section of 20 feet. The next pour was approximately 12 feet. By the next, I mean pouring from the previous concrete that had been finished, and completed the arch, which was 12 feet from the slope of the hill out to the edge of our concrete, and reduced the menace. That left approximately 40 feet of the arch of this south tunnel to be poured, which was done by hoisting the concrete up to the floor line of the portal building and using buggies from that point to convey the concrete into and upon the forms of this open section, thereby completing the pour of the lining for 92 feet, and the portal section. Just as soon as that was completed I began pouring the north tunnel. Meanwhile, while we were doing this other work in the south tunnel I had prepared the north tunnel for the receipt of con-

(Testimony of Lewis Michael Larson.)

crete by erecting the forms, getting the reinforcing steel in, getting the pipes, the concrete delivery pipe, which is a 6-inch pipe that led from the Hackley gun to the point of discharge, that was installed, and we were permitted at that point to place a pipe in each wall. I will drop back and state that in the first pour it was not permitted, that is, we would pour one wall at a time and then pour the next wall. I tried to put that point over——

Q. Not permitted by whom?

A. By the District Engineer or his representative, and consequently we poured one foot on one side and then shifted to the other side to pour that; we were permitted to finally pour four feet on each side and then shift our concrete [627] operations over to the other side and pour four feet, but there was one handicap in the delivery of concrete by the pneumatic method, that you cannot work very close to that, because it is much like working in front of a Gatling gun, the men have to be in the forms while the concrete is being delivered and then the concrete operation held up while the men get into the forms and vibrate—by “vibrate” I mean a manufactured vibrator that is operated either by electricity or by air, that causes the concrete to move into all sections of the form and compact the concrete. To do that it was necessary to stop the delivery of concrete each time it was necessary to do that vibrating, which prolonged the period of time for the concreting of this portion of the tun-

(Testimony of Lewis Michael Larson.)

nel, as I recall it, for twenty days, from the time that the excavation was stopped until the concrete operation was finished. The District Engineer permitted us in pouring in the north tunnel to go to a point about fifteen feet above sub-grade, enter the pipe in each of the two walls and pour one wall at a time. This was a very big help, the conditions being that as we poured the wall and the concrete came toward the portal you could use the same method of beginning at the farthest extended part of the tunnel and bring it out toward the portal. As it built up in the wall at the farthest point distant from the portal we took off sections of pipe, five-foot sections in most cases, and kept shortening the delivery pipe until that wall was completed to the elevation the Engineer permitted, and it was keyed at that point by a wooden key that could be later removed. Then the other wall was poured to the same elevation and keyed. The next operation was to pour from a point at a little distance below where the concrete would flow from the arch. At that point we built another bulkhead with the key in it and put the pipe within the bulkhead and began the delivery of our [628] concrete through that in that position on one side and then shifted to the other side. With this method of delivery it was possible for the vibrator to work continuously in advance of the delivery of the concrete and it shortened our operation materially. We succeeded in building that section by the delivery through those

(Testimony of Lewis Michael Larson.)

four pipes and the final closing at the top in a period, as I remember, of twelve days; and I also recall distinctly that the last few yards were poured in a very heavy downpour of rain, at the beginning of the rainy season. We just got out in time. The reason for having to change our method of pouring was due to the fact that the structure could not stand without the core in there for support, because the plan that I had indicated in my estimate for pouring could not be used, because you could not get your forms in; the forms traveling on a carrier would be obstructed from getting in by the core having to be left in position. In my thought on the estimate it did not occur to me that the condition of the ground was such as it developed to be. I was looking for self-supporting ground. We were always hoping that would be found. When the completion of the pouring was done we received orders from the District that the core must not be removed until the concrete had reached a stage of curing for 21 days after placing; consequently, having the drift full of timber, and requiring the core for support, it was impossible to carry on with the excavation without first removing the stulls and the supports that were holding the forms. I should state in that connection, too, in the pouring of the north tunnel, where we had developed that terrific pressure from the left-hand side, that we had as many as three stulls of 4 by 4 on that little short 5-foot-3 segment to the core to prevent that terrific weight

(Testimony of Lewis Michael Larson.)

from crushing in, and in spite of that some of our segments moved in as much as ten inches and we had [629] to trim back of the double row of stulls; it was both tedious and difficult, and when we did pour the concrete we had to bring the concrete up to the point where it practically enclosed these stulls before we were compelled to get it out and when we did get it out it would twang like a violin string or a guitar string, showing the terrific pressure that we were carrying. That practically completed our operations in that tunnel.

Q. Was any of the ground encountered in this section of the tunnel self-supporting?

A. Decidedly not.

Q. I think you stated you started the excavation of this section of the tunnel about August 28, 1934?

A. On the south tunnel that is as near as I can recall the date; on the north tunnel on September 1.

Q. Do you recall when the excavation was completed in the south tunnel?

A. I think the excavation was completed in the south tunnel approximately on October 13, as I recall it now.

Q. 1934?

A. 1934; and the concreting requiring 20 days, would be about the 5th of September, would it not?

Mr. Tinning: Q. November.

A. November.

Mr. Marrin: Q. In the time between the placing of the timbers in the drift and the commence-

(Testimony of Lewis Michael Larson.)

ment of the concreting operation, had the timbers moved any?

A. Yes, they were moving in continuously in spite of the fact that we tried to hold them with stulls.

Q. And had to be trimmed before the concrete could be poured?

A. And had to be trimmed before concrete could be poured, most of them.

Q. These timbers had only been in a short time before concrete was placed? A. Yes.

Q. How large were these drifts?

A. The lower drift, as I recall it now, was about 9 feet high and about 10 feet wide. [630] The reason for making it of that size was it was developed that we might have to go more than the 40 feet, and consequently we would have to find some means of taking the muck out, and taking the muck with small cars was not possible; consequently, as a matter of getting 5-yard cars in there, and no smaller drift could be used for getting 5-yard cars.

The other drifts were confined to the size that would be necessary to put the concrete forms in, the purpose being to leave as much of the cheap muck as we could in the core, and consequently that reduced the size of the drift, and to get the muck out of the drift into cars is a more costly operation, because that has to be done by hand, than it is to do the operation by power equipment.

(Testimony of Lewis Michael Larson.)

Q. Did the ground condition have anything to do with the size of the drift? A. Yes.

Q. What?

A. The ground condition controlled the size of the drift. The lower drift that I mentioned was made to a certain size for core surface but the rest of the surface used from 7 foot segments to 5 foot 3 segments and wall plate in there at the contact between all of the segments to aid along with the collar braces in keeping the structure as a unit; consequently, we had two additional drifts in each of the tunnels over what we had contemplated, and we had spacing of timbers at four feet instead of five feet, and we had wall plates extra, and every time we put in a segment that would have to be taken to the mill, because it had to be framed fanned, you have extra collar braces to cut, the wall plates have to be cut, you have many more boards to be handled, and it all adds to the cost, not only in the material, but it adds to the cost in time and the cost in money.

Q. Would you describe generally the character of the material in this section of the tunnel as it appeared to you?

A. In the [631] south tunnel it was broken formation, apparently sandstone, that is what I thought it to be; I am not a geologist. The fact that I name it something, it does not follow that I am right in naming it; that broken formation continued except in the top drift—I think the geologists would call mud some form of rock, but I will call

(Testimony of Lewis Michael Larson.)

it mud—we ran into mud in the third drift of the south tunnel, and the fourth drift of both sides of the tunnel; this refers to the south tunnel—and in the fifth, two fifth drifts and the top drift. In the north tunnel, I should mention that on account of the broken condition there it was necessary to advance spiling; it was not necessary to drive spiling except in the mud section; you cannot drive spiling in rock, you have to advance it.

Q. Did you do any breastboarding in that section?

A. In the south tunnel we breastboarded in the third drift and some in the fourth drift on the right-hand side, and on the fifth drift on the right-hand side, but on the left-hand side there was very little breastboarding because the mud was stiffer there, the water from above that I spoke of in the earlier part of my testimony yesterday, from this stream, a little creek that flowed down into the approach cut—however, we had cured that, or thought we had, but during the period of time that it had been going there it had caused disintegration of the material and that continued up to the point where we left off 92 feet in from the portal. Now, in the north tunnel the material was very badly broken, I think was a sandstone, but the same method had to be pursued, except that breastboarding was not necessary in that tunnel, but we had to be very careful advancing our spiling in that tunnel to prevent the material running away, and in

(Testimony of Lewis Michael Larson.)

one instance it did get away from us, not because of the condition of the material [632] as much as because we did not have experienced people who were working in the tunnel; I don't know what their vocation was, and it was a very dangerous condition, because the lives of the men depended upon the understanding of the operation by experienced help, and we had so little of it.

Q. Did the fact that you were required to place concrete first in one wall of the tunnel and then go over and place it in the other wall have any tendency to cause cold joints to form?

A. Yes, it did.

Q. Will you explain what is meant by "cold joints," first?

A. The concrete is supposed not to be continuously poured without a key being placed in it after it had been in the form for a period of thirty minutes; after that you think of it as a cold contact, and it was found impossible to transfer our pouring operation from one side to the other in that period; in fact, in one case I remember keeping time on it, and it took more than an hour and a half to get over on the other side; it was a very difficult and very slow operation.

The Court: We will take an adjournment now until tomorrow morning at ten o'clock.

(An adjournment was here taken until tomorrow, Friday, April 15, 1938, at ten o'clock a. m.)

Friday, April 15, 1938;

10:00 o'clock A. M.

LEWIS MICHAEL LARSON,
recalled for the plaintiff.

Direct Examination (continued)

Mr. Marrin: Q. Mr. Larson, you testified, yesterday, that the method you planned for concreting the tunnel was to use the pneumatic gun which you described. At the time you made your estimate, did you consider any other means of applying the concrete lining in the tunnel? A. I did.

Q. What method did you consider?

A. The method known as the "Pumperete."

Q. Would you describe briefly what that method is, and how it differs from the pneumatic gun?

A. This method, your Honor, is illustrated on the upper half of Exhibit 35. The forms are similar to the forms used, and the form carrier is similar to the form carrier used in the other method. The concrete is brought in, in much the same manner. It can be brought in, either in cars or in agitators. In this instance, it was brought in in agitators; the concrete comes in there, and is dumped into the pumperete outfit; and the pumperete outfit handles the concrete in a way different from the pneumatic gun,—for example, dispels it out at a violent force. In the pumperete, it is pumped the same as water. It is put into the pumperete gun, which has, in some cases, one cylinder, and in some cases, two cylinders.

(Testimony of Lewis Michael Larson.)

It is a safe method, because men can work in and about it without any difficulty.

At the time that the estimate was made up, this method had been in the experimental stage, having been tried out at the Boulder Canyon; and Mr. Stephen Bechtel, the president of the Six Companies, then of the W. A. Bechtel Company only, asked me if I had given it [634] consideration. I told him I had been hearing a great deal about it, but I did not understand that it had yet proven feasible. He suggested I get in touch with the Link Belt Company.

Mr. Marrin: The Chain Belt Company, isn't it?

The Witness: The Chain Belt Company—who were the agents for that method in the Western country. I called them up, and they sent over Mr. Nichols. This was some time—probably about the 10th day of March; that is as near as I recall the time.

Mr. Tinning: Don't you think, Mr. Marrin, this testimony should go in without hearsay as a result of this witness's investigation?

Mr. Marrin: Yes, I think so.

Q. Mr. Larson, you might simply testify to your investigation—that you investigated it, and why you did not adopt that method in your estimate, without saying the conversations with third persons?

A. The result of that conversation was—he told me—although there had been progress made in its

(Testimony of Lewis Michael Larson.)

use, and it was about the time when the bid must be put in, I was afraid to use that as the controlling unit in my bid; resulting in my adopting the pneumatic gun, which was in general use for tunnel work and the accepted practice up to that time.

Q. I think that covers it. You were describing yesterday, the excavation of the first 92 feet in the south tunnel and the first 110 feet in the north tunnel. You said the length of time that was included in your estimate for the excavating of those tunnels was what?

A. The first 40 feet, I had estimated to use 20 days for the excavation. By that time, the crews would be lined out and separated sufficiently far that it would be a going operation without interference from one part of the work to the other.

Mr. Tinning: Q. Mr. Larson, how many days did you say?

A. 20 days for the first 40 feet. In the drift system, I proposed, at that [635] time, to continue on with the wall plate method,—change to the wall plate method, and proceed with the excavating while the concreting was being done. My thought, then, of course, was that I could remove the core, and move this concreting unit into the tunnel and pour from steel forms. I had in mind, at that time, pouring the first distance of 40 feet from the outside of the tunnel, working from the 40 foot point in, and work toward the portal. By the time that was poured, I appreciated that my estimate of progress was right

(Testimony of Lewis Michael Larson.)

and would be a considerable distance ahead of the excavation, on the wall plate method, and would be in good time for lining, by putting my ramp between the face that was being excavated and between the forms. It was necessary, under that method, to have some means of backing up, to follow your excavating and also to fill from the previously poured concrete, back to a new bulkhead. That would have given me ample time, after the concreting had been done for the first section, to make those changes; and I could then proceed, if my estimates were right, both in progress of excavation and progress of pouring, an average of 10 feet per day of concrete; an average of 10 feet per day of concrete would be poured, to keep up with an estimated excavation of 10 feet. I required 92 feet of excavation in the south tunnel, instead of the estimated 40, on account of the nature of the ground; and the period of time on the schedule would have required 26 days for excavation, and, as a matter of fact, it took, I think, 60 days, or 62. The north tunnel,—the distance being a little farther in,—would have taken us, if the schedule had been kept up at the rate I figured—we would have had that done in 27 days; and, as a matter of fact, it took us something over 60 days—67—I have forgotten the correct time. I have my notes here, if I may refer to them.

Q. Were those notes taken from the records?

A. Yes. [636]

Mr. Marrin: Is there any objection to the notes?

(Testimony of Lewis Michael Larson.)

Mr. Tinning: No; we have no objection.

The Witness: A. —The record shows that the excavation, in the south tunnel, begun August 23rd, was completed October 13th. Allowing for the holiday of Labor Day, it meant 51 days. The core removal, from November 26th to December 8th,—an additional period of 13 days,—meant the requirement of a total of 64 days for this 92 foot excavation, the estimated time being 26 days,—a time loss of 38 days.

In the north tunnel, the excavation, begun September 1st,—as soon as we could get in,—was completed on October 27th; a total of 56 days; the core removal required 8 days; making a total time period of 64 days, as against an estimated period of 27 days, or a time loss of 37 days.

Mr. Marrin: Q. How many hours a day did it allow the plaintiff working?

A. On this work, it was forced 24 hours a day, every day that was not a legal holiday.

Q. During all the time you were on the work, was it going on for 24 hours a day?

A. With all the vigor we could give it, it was.

Q. After the lapse of 21 days, to allow the concrete in this first portion of the tunnel to cure, was excavating resumed?

A. As soon as the 21-day period was lapsed, excavation was begun in the south tunnel, which was the one that had been first concreted. Excava-

(Testimony of Lewis Michael Larson.)

tion was resumed on the core on the 26th day of November, according to the records.

Q. According to your estimate, Mr. Larson, and the date that excavating was resumed on these tunnels, how far would they have been excavated, had you been able to follow your estimate?

A. Well, I will refer to my notes again. The distance we should have been on December 12th, in each tunnel, was 1030 feet, if there had been no [637] delay, and had gone on as we anticipated.

Q. Mr. Larson, will you proceed to describe the excavation of the tunnels, from the point where you resumed excavation in December?—I might ask you, preliminarily: Were you in charge of both tunnels?

A. I was in charge of both tunnels up until December 8th.

Mr. Tinning: Q. Was that December 8, 1934?

A. Yes; this is all 1934.

Mr. Marrin: Q. After that date, what particular work were you in charge of?

A. I was then in control of the north tunnel; and Mr. Whitmire was placed in charge of the south tunnel.

Q. By being in control, you mean you superintended the work?

A. Yes, I superintended the work.

Q. During the period you were in charge of construction of the north tunnel, did you frequently visit the south tunnel?

(Testimony of Lewis Michael Larson.)

A. On an average of about three times a week.

Q. You were familiar with all of the conditions in connection with the excavation of that tunnel during that period?

A. I think I was thoroughly familiar with that.

Q. Will you proceed to describe the method of operation on the north tunnel, between the period when excavation was resumed and until you left the work on April 30, 1935?

A. As I previously stated, I had the core excavated, and brought it to the point very near the end furthest removed from the portal,—the end of the lining. The ground was in such condition that it was not safe to complete the excavation in a vertical position. I brought it to the end of the lining. I breastboarded the core, to prevent the slippage of material,—the rocks. After breastboarding, I began the excavation of the two drifts I described above, on the wall plate drifts on each side; and, at the same time, I began the excavation of the top drift; and, in excavating the top drift, because of the condition of [638] the ground, it was necessary to give support to the top. In ground that is heavy and uncertain and carrying weight, you have to raise your cap, corresponding in proportion to your results as to the weight you are carrying on the cap. For that reason, the top drift is driven, to prevent the ground from running into the drift; and also to give the necessary elevation to the segments that come up from the wall plate. When I

(Testimony of Lewis Michael Larson.)

had proceeded in a distance of about 20 feet, on the wall plate drift, a similar distance on the top drift, I proceeded to put the wall plate in position. I am a little ahead of my story. It should be stated: when I was in about 20 feet in the wall plate on the top drift, I then had to excavate this second drift immediately above the wall plate drift, continuing the other operations described in the two drifts next and in the top drift, and providing for the safety to the men who were working below. When those drifts immediately above the wall plate drift were advanced about 20 feet, I started another crew on the connecting drift with the top drift, and then went on with concreting and more excavation. These, of course, were duplicated on each side of the tunnel. When all the crews reached a point 20 feet in from the erected section and the timbers forming the arch had been erected, and the complete arch formed there, and the collar bracing, and all that is necessary to hold a structure in a firm condition, had been finished, I removed the breast-boards from the core, and began, with the power unit, to excavate the core. It is necessary you do that in order to get bracing under the suspended wall plates. We had removed possibly three or four cars of muck, with a shovel, when the core broke; and, as it sloughed down into the tunnel, it broke to a point where our arch approximately had ended. That was a fortunate point, because, had it carried further, it would have caused a collapse. As it was,

(Testimony of Lewis Michael Larson.)

no harm came from it; but it was evidence that it [639] was an unsafe distance, and, consequently, I stopped the excavating of the core, and proceeded to drive the wall plate and the remaining drifts for the wall plate in for a distance of another 10 or 20 feet; and I resumed excavating on the core again, but the core was in such condition that it was unsafe to remove it, as a unit, without some spiling. I started at the meeting point of the core and the wall plate, and began drifting down, in a vertical position, from the wall plate. As I did so, I breast-boarded under the wall plate again. On the wall plate drift excavation, I placed spiling back of the concrete section, lining section, and breast-boarded against the core. If I had not done that, the core would have collapsed, or the material from the drift would have collapsed and trapped the men who were working there. I had to carry the excavation clear on down to the point where I could put in any posts. I tried to carry about 4 foot spacings, when I contemplated 5 foot spacings would be possible, when I made the excavation to a point under the free end of the wall plate, and put in one 4 foot spacing against the breastboard that had held the material immediately under the wall plate and against the wall plate drift.

Q. The posts are for support under the wall plate?

A. For support under the wall plate, yes. They carry from the wall plate down to the subgrade.

(Testimony of Lewis Michael Larson.)

The timbers forming the spacing, at this particular time, were 12 inches by 12 inches. As I proceeded to excavate for the next section in the same manner, the weight began to become so heavy on the wall plates that I had to drop back and put in more posts, in a spacing of 3 feet that existed between the first and second posts; and finally had to make a solid back there. As quickly as I could put the posts in, the pressure from the top and from the sides had the tendency to force this in; and I proceeded, from then on, for a distance of 20 feet, putting the posts in almost solid. When I reached that point, the wall plate began [640] to pulverize, from the weight; and I had to drill holes through the wall plate, and bolt the wall plate in, so it would not fracture. It convinced me of one thing: that we were going to run into a condition, or we might run into a condition, whereby the wall plate would be too light. I changed the wall plate from 12 by 12 to 14 inches by 14 inches. The danger of the material running away from under the wall plate is apparent if the wall plate is not supported; and that is the reason for enlarging the wall plate.

This method that I have described was carried on and the material that was encountered was a broken material that I interpreted as sandstone. It would not stand without support. When I got a distance in, as I recall now, about between 150 feet and 200 feet from the portal, I ran into a laminated formation—that is another word,—being inexperi-

(Testimony of Lewis Michael Larson.)

enced in geology,—for chert. The laminations offered a little resistance, but, after I penetrated further in, they began to pulverize, and finally offered no resistance at all and contained a little water that tended to run in under, and had to be removed from the breastboard; and we had to be very careful, in advancing the spiling, to see no material or rock formed a cavity. In entering the posts, we had to be very careful in excavating down at a distance not to exceed 4 feet, the material under the wall plate board and the breastboard against the core, and the spiling and the outside wall of the tunnel, and then the post would be entered. Then it was excavated, with the power shovel, a distance of about 4 feet. The muck that comes from the upper drift is dropped down into the lower drift, where it then is picked up and hauled out and dumped where the power shovel can pick it up. There was a little difficulty in that, because of men working directly nearby, and we had to erect scaffolding for those men, to prevent any material falling off from that transportation medium [641] onto the men working below.

After running through possibly 20 feet of this laminated material, I ran into what I thought, and still believe, was a sandstone. It offered a little better resistance than the laminated material had, but it was anything but self-sustaining. It would not support itself, and I had to offer the same support to that that I did on the other material; but, as I

(Testimony of Lewis Michael Larson.)

advanced into that, it began to become less firm. I had perhaps penetrated it for 20 feet when I ran into some more of this laminated material in a less substantial form than the preceding; that was: it was more broken, and, as I recall it now, at around Station 114,—which would be 114 plus 00,— I think is the proper way to describe it—it was a completely pulverized mass.

Mr. Tinning: Q. Would you mind my interrupting you, Mr. Larson. You have given us a station, as 114; 114 plus 00. That was before you ran out of the 20 feet that you thought was offering some resistance and came into that broken material, was it?

A. I first ran into one section of this laminated material for about 20 feet. Then I ran into about 20 feet of the sandstone; and then I reentered this stuff I am speaking of, that was so badly pulverized.

Q. When you ran into that laminated material, was that about 40 feet towards the west portal from Station 114 plus 00?

A. Well, it would be about 60 feet, I should say, where I first entered it. Then I ran for 20 feet, and then the sandstone for 20 feet; then the pulverized material. I am giving you it approximately. The pulverized material of this second laminated section, where it began to run out and enter that sandstone again. In this case, it was also 20 feet— If you take 20 feet, 114 plus 00,—that would be 113 plus 80; subtract 20 feet from 113 plus 80, and

(Testimony of Lewis Michael Larson.)

you have 113 plus 60. That was the end of the first laminated section; and 20 feet from 113 plus 60, that would be about the first contact point of the laminated material. [642]

Mr. Marrin: Will you proceed, Mr. Larson? Would it help you in giving these stations to have this poster back?

A. It might. It will help in this, that I can illustrate to the Court what I mean.

Q. The witness is now referring to Plaintiff's Exhibit 42.

A. The cross section legend by the letter "B". The breastboarding, your Honor, to which I referred, is indicated by the cross pieces. There are stulls running against the core in the direction of the drive that are not in evidence here, and the spiling shown on the outside of the post.

Q. Did your estimate contemplate having to do that breastboarding and spiling in the wall plate section?

A. Not at all. In the wall plate section when you use the wall plate method, it is ground where you expect that when you drive your wall plating you can excavate with a power shovel, by using material for blasting, that is, dynamite, to break your rock and put up your posts under your wall plate. That is generally the thought in construction, and it was my thought in this instance. My thought in this instance was I could go in with these two wall plate drifts on each side, take the drifts immediately

(Testimony of Lewis Michael Larson.)

above them and let that material fall by gravity into the lower drift, and then the next drift above that let the material fall by gravity into the lower drift, and then the top drift, and let the rest of the material fall by gravity, but after I found the conditions that prevailed there it was imperative that I start the top drift and wheelbarrow that material out of the top drift and then drop it down into the lower drift. It was necessary to raise and lower the caps which necessitated the framing out in the yard of the closing segment that was between the top drift and the drift immediately above the wall plate drift; one end only could be framed and the other one cut to length to fit. [643]

Q. Will you proceed with your explanation of the character of the ground and the excavation method at the point where Mr. Tinning asked you that question?

A. About Station 114 plus 00, as I now recall it, I encountered a sandstone that offered a little better resistance than the previous sandstone, but it was broken and fractured. As I proceeded with the excavation it became more broken—I do not recall the station definitely where it needed side support, but I think it was about 30 feet, possibly 114 plus 30, that the pressure on the segments—I will describe that to your Honor so that it will be understood more clearly; the pressure on the segment at the meeting point—

(Testimony of Lewis Michael Larson.)

Q. The witness is referring to Plaintiff's Exhibit 42 and the type B section.

A. At the meeting point of the segment off from the wall plate and the segment immediately above it, the angle was very nearly a straight line, that is, it offered very little resistance; the radius that forms that curve is something over 27 feet long, if I recall, 27 feet 2 inches, which means a very flat curve, and when we tried putting timber up there we had very little resistance at that point. This weight that I have mentioned that came from the crevice on the north side of the north tunnel, and which weight I felt all the way through, and where I had so much trouble holding the ground when I was concreting continually on that left-hand side; it continued, as a matter of fact, with more or less severity until I reached the station, as I recall now, 115 plus 60 or thereabouts; the weight became so heavy at this point, which would be Station 114 plus 30, that I had to put some very heavy timbers from these two segments down to the wall plates on the opposite side of the tunnel in order to prevent collapse.

I forgot one thing, when we entered the excavation after [644] concreting I had a batch of posts, that was almost a solid mass of timber in that first 20 feet; the pressure was so heavy at that point that I had to carry timbers across from one wall plate to the other in order to prevent collapse. Now, the weight registered more at this particular point 114 plus 30, approximately; the weight regis-

(Testimony of Lewis Michael Larson.)

tered at the angle between the segment, which is the wall plate segment, to the segment immediately above it, and it was there that I had to support. As I advanced with these segments the material seemed to stiffen a little bit, the rocks became a little firmer, and I had advanced possibly another 60 feet, which would make the station about 114 plus 90, when I began to take courage from the stiffening of the rock, I placed a hurry-up order for the drill carrier, always looking for that self-supporting ground, and believing that we would find it; I thought here was a continuing stiffening of the ground for about 60 feet, and we were entering into this formation that the geologist had indicated might be found. I stopped all drift excavation to go into the economic open face method, which would allow me to shrink my excavation by at least a foot, so we save expense of concrete, save me timbering for protection of the men, re-using my timbers after I had taken them out over and over again until they were worn out; it was all an economic move. I penetrated that material for a distance of 12 feet and then proceeded cautiously, because I saw there was a softening, going on for another distance of about eight or ten feet, as I recall it, when suddenly a big block of material containing about 12 yards, 10 or 12 yards, dropped out from the roof. It showed that I could not carry on with a full face method. The drill carriage in the meantime had arrived, and I continued the erection of the drill

(Testimony of Lewis Michael Larson.)

carriage, thinking that that was possibly just a little fault line, and I would soon pass into the firm material. I was [645] not discouraged, but expected I would get to the firm material; it was necessary to go back to the wall plate method for the safety of the men and safety of the structure. I proceeded again to reopen my drift, and by that time two weeks had been lost. I should mention, too, that in the beginning of the excavation, after the concrete lining was put in, it takes two weeks at least to run your crews out and get them gathered so that they won't interfere with other following operations; whenever you change your operations you have to figure about two weeks loss, which was the result in this instance, by the time I got the crews all lined up again and properly faced the material, the pressure that I had felt on the left-hand side of the tunnel I now felt over the top, and it ran across the tunnel at possibly 45 degrees, or approximately that, taking somewhere between 60 and 80 feet in crossing, and the pressure then began to register at the same point between segment A and segment B, over the right-hand side of the tunnel.

Mr. Tinning: Q. Will you give us the station, approximately?

A. I think this is about Station 116; possibly it would be about the center of it.

Mr. Marrin: It is understood, Mr. Tinning, he is giving these from recollection, and they are approximate.

(Testimony of Lewis Michael Larson.)

A. Yes, from my recollection of four years back; it is not easy to recall an exact location. I had found, at least I concluded that my greatest danger lay beyond the contact point of A and B segments. To accomplish two purposes I transferred my wall plate up to that point; and when you have a long wall plate in and you have a number of sets carried onto that wall plate, you have an outward thrust from the mere formation of your arch on that wall plate; that had a tendency to stiffen that very weak point; it had another virtue, it assured me of cheap material in the core. [646] The fewer drifts the cheaper your material is, the better progress you can make under average conditions, the more money you can make and the more money you can save.

Q. When you say you transferred the wall plate to that point you were pointing to type C legend on plaintiff's Exhibit 42, and you pointed to the fact that you transferred the wall plate to a higher point?

A. Yes, from the top of the post to the top of the segment that had formerly rested on the wall plate. Now, the pressure became so heavy at that point that in spite of that cautiously moving the wall plate began to cave, and I had to put stulls across from the new position of the wall plate, from one wall plate to the other.

Q. Did you carry the original wall plate also in that?

(Testimony of Lewis Michael Larson.)

A. No, I did not. I then carried it as an independent set up to the wall plate, that is, I placed it upon the former post of the segment that had formerly rested on the wall plate, and the top of that segment was a support for the new wall plate. The work had not advanced very far until the timbers in this weakened portion began to come down pretty rapidly. I had to suspend operations in that place and send men back to retimbering; some of the timbers had gone down 12 inches into the concrete line. I began a complete retimbering operation and placed in an almost solid timbering over the arch, which I thought would be sufficient to hold it, but I could not hold it that way. It still threatened to break through the timber, so I had to erect from the wall plate to the top segment upon each side an A frame support underneath the wall plate. I had to take the stulls from one side of the segment to the other side to prevent collapse.

Q. Will you explain what you mean by an A frame? A. A A frame—

Q. Do you want to draw it on the board?

A. I think possibly it [647] would be a little clearer if it could be visualized than explained.

Q. Perhaps you can simply draw it in here, just a line to show the Court what you mean by an A frame.

A. Well, assuming this to be the wall plate on this side, and this to be the top segment, the A frame support requires the placing of another timber under the cap, here, and carrying a direct leg

(Testimony of Lewis Michael Larson.)

down to the wall plate from each side, which took the support inside of the concrete but it was the only thing that could be done to prevent collapse, and then the timbers that I talked about carried across, the stulls across, they were carried across about an elevation of 4 to 6 feet below the top segment. That describes it. I again proceeded with the excavation and I started a drift operation again. As I did so I ran into a more broken mass, much of the rock about the size of my hand, but it was firm and hard, but there was considerable water in it. Later on that spread from the wall plate drift up to the top drift and it appeared it was finally going to cover the whole tunnel. This was the condition of the tunnel when I left work on April 30th.

Q. You said the ground was firm and hard. Do you mean self-supporting?

A. No, it was very much the reverse. It was just a mass of loose rock, fractured, broken.

Q. Now, will you point out on Plaintiff's Exhibit 42 the point to which you were in charge of the excavation of the north tunnel?

A. I was in charge of the excavation in the north tunnel to the point indicated here by the legend "B", which was an average tunnel distance in of 530 feet.

Q. From the west portal?

A. From the west portal.

Q. That is at station approximately 115 plus 60?

A. Thereabouts, yes.

(Testimony of Lewis Michael Larson.)

Q. Now, Mr. Larson, I will ask you was any of the ground encountered by you in the north tunnel self-supporting?

A. No, except possibly 12 feet, the 12 feet that I referred to when I took courage and ordered [648] the drill carrier.

Q. And tried the full face method?

A. And tried the full face method.

Q. Will you describe the method of excavation and the ground condition encountered in the south tunnel during the period up to April 30, 1935?

A. Yes. The method shown on Exhibit 42 cross section marked "E" was the method that was taken up by Mr. Whitmire; I had started the top drift; he carried that on because there was a mud patch in there, and it was evident in the drift when I discontinued the drift in 92 feet that the mud was rising and that we would probably soon be out of it; consequently the top drift was put in there to control that mud patch, and as I recall it now it was carried for a distance of about 40 feet when the mud ran out. Mr. Whitmire then carried on with the one drift to the top of the plate, to the location of the wall plate on each side of the tunnel for a distance of about 42 feet as I recall it now; that would be about 112 plus 85, approximately.

Mr. Tinning: That was what, when you say one drift—was it on each side?

A. On each side of the tunnel, one that was advanced to the point where men could work without

(Testimony of Lewis Michael Larson.)

danger from the operations above. Mr. Whitmire began to take out the ring, that is the section between the wall plate and the top drift; he used a different method from the one that I used. He allowed that material to drop down into the lower drift, and he had a power unit that he termed a Bagley, it is a scraper that is propelled ahead by a double drum hoist, one block for the line to run through fastened at an advanced position; when one hoist is applied it pulls the scraper or drag-line into the drift; when the other hoist is applied, that is, the power is applied to the hoist, it has the reverse action of pulling this scraper out with the material. This material then was hauled out to the toe of the core [649] where a power shovel picked it up and loaded it into cars. He found it advisable to change the method on account of the ground conditions. This little firmness that I encountered when I was in 92 feet, of course, had given us the indication and belief that we would find self-supporting ground at that point. We were disappointed.

Q. Mr. Larson, that Bagley drift started at 92 feet, and where did it end?

A. At about plus 82, but the Bagley method was continued for many hundreds of feet beyond that, or at station approximately 112 plus 82, Mr. Whitmire changed the method of operation as indicated by the legend F.

Mr. Marrin: On Plaintiff's Exhibit 42?

(Testimony of Lewis Michael Larson.)

A. On Plaintiff's Exhibit 42, yes. That method was pursued by him during the period of time that I remained in the tunnel, and observed the excavation, and it consisted of running a lower drift at sub-grade or approximately sub-grade elevation, on each side of the tunnel, followed by a drift immediately above that, also on each side of the tunnel, which material was dropped down into the lower drift and removed by this Bagley process that I have described. When the advance was sufficiently forward that he could put up the timber for the ring, that would be posts for the ring, he would begin on the ring, excavate it as one unit; that is, work both ways, drop the material down into this lower drift and continuing the removal by this Bagley. As this excavation of the ring was accomplished he left the core in for removal by power shovel after the ring had been carefully timbered; he used additional timbers; I used a seven-ring arch, he used a nine. That was about the departure of the method in regard to the support of the arch. When he had gone in possibly, as I recall it now, 400 feet, it might be more or less, he lost the lower drift; and he encountered a formation which appeared to be cherts. I defined it [650] for him as cherts. The material ran in with the water.

Mr. Tinning: What station?

A. I would estimate that at about probably 116.

Q. And upon which side?

A. On the lower drift on the left-hand side.

(Testimony of Lewis Michael Larson.)

Q. That would be the north drift?

A. That would be the north drift of the south tunnel; he carried a second drift over that, so that it would give him room to place the support against the side wall to prevent any further material running into the drift and when that was accomplished he resumed the excavation as heretofore on the lower drift, followed by the second drift, and continued to do that in that manner during the time when I was in the tunnel.

Mr. Marrin: Q. What was the character of the ground encountered by Mr. Whitmire during that period in the south tunnel?

A. My judgment was that it was a little firmer than the ground in the north tunnel, but it had more water.

Q. Was it self-supporting?

A. There was none self-supporting in the tunnel; there was no self-supporting ground in either tunnel during the period that I was there except the 12 feet that I mentioned in the north tunnel.

Q. To what point had Mr. Whitmire carried his excavation at the time you left the work on April 30?

A. He had carried it 618 feet of average tunnel. By that I mean taking the yardage of the several drifts and coring and ring, adding them together and dividing them by 35.61, which was the neat excavation for the tunnel, that gave him the distance 618 feet in and gave me the distance of 530 feet in.

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: Q. Would you give us the station?

A. 618 added to 111 plus 53 and on the north tunnel 530 added to the [651] station 111 plus 42.

Mr. Marrin: Mr. Larson, I show you a photograph which is entitled "Inside of the tunnel West Portal May 1, 1935, Type B," and ask you if you can tell me what that represents?

A. That represents the material in the tunnel at the time I left the work.

Q. And the condition of the timbering?

A. And the condition of the timbering at that point.

Mr. Tinning: I suppose, to make the record clear, you are referring to the north tunnel?

A. Pardon me, it was the north tunnel.

Q. The tunnel of which you were tunnel superintendent?

A. That is correct.

Mr. Marrin: I offer that in evidence.

(The photograph was marked "Plaintiff's Exhibit 43.")

[Set forth in the Book of Exhibits at page 279.]

Q. You said you left the work on April 30, 1935. Were you again employed by the plaintiff in connection with this work?

A. I was.

Q. When were you employed?

A. On August 29 I was called in—

Q. August 29, 1935?

A. Yes, August 29, 1935 I was first called in to a conference and asked to make an examination of the tunnel.

(Testimony of Lewis Michael Larson.)

Q. What had occurred in the tunnel at that time?

A. The tunnel had caved in, the north tunnel.

Q. What were you employed to do?

A. At that particular time I was employed to make an investigation and report on the condition. At a later time, on the 16th of September, I believe—

Q. 1935?

A. 1935, I was asked to come in and recover the tunnel at that point and concrete it and put it back into safe condition.

Q. By "recover," you mean you were asked to remove the caved-in [652] material and concrete?

A. Yes, and leave it in safe condition.

Q. At about what point or what engineering station, if you can give it in the north tunnel, had the cave-in occurred?

A. It apparently had centered around this station 114 plus (), where that running material and badly broken material had occurred.

Q. Will you just describe briefly the appearance of the cave-in when you first arrived on the work?

A. When I first arrived on the work the material had filled the tunnel to an estimated distance at the bottom of about 130 feet; the timber was completely down for a distance of 57 feet and was more or less in a point of collapse for a distance of probably ten feet more on each side of the caved material. The material, itself, was mostly the pul-

(Testimony of Lewis Michael Larson.)

verized material that I had thought to be cherts; on the east end of the cave, where some of this sandstone that I mentioned we had encountered was down; one large block containing a great many yards, I don't know how many, had depressed the segment on the south side of the tunnel, and it was such a large block, that when work proceeded on recovery we had to take off little points of it and crawl under it instead of removing it as a mass. [653]

(After Recess.)

Mr. Marrin: Q. Mr. Larson, you stated, this morning, that you had excavated the tunnel to a certain point at approximately Station 116 in the north tunnel. Did you want to correct that testimony?

A. Yes. I have checked up on the stationing—530 feet added to 111 plus 42, I think, makes 116 plus 22; that is the average spacing.

Q. Did you excavate about to the point on Exhibit 42, as shown by the end Section "C"?

A. Correct.

Q. I would like to draw your attention to Plaintiff's Exhibit 31, one of the models. Does that illustrate the system that was used by Mr. Whitmire in the south tunnel?

A. Yes; according to legend "F" on Exhibit 42.

Q. Mr. Larson, will you proceed to explain how you removed the caved-in material from the north tunnel?

(Testimony of Lewis Michael Larson.)

A. I will use this,—one of the cross-sections here on Exhibit 42,—to illustrate a condition similar to the one that I used. It is indicated by cross-section "I" on Exhibit 42. I will explain to his Honor that the bodies had been found at about the location of the lower drift on the right-hand side.

Q. You mean by "bodies," the men who were killed in the cave-in?

A. Correct, yes; and the rescue crews had excavated in to the point where the bodies could be recovered. The work had stopped there; and, when I took charge of the recovery work, I placed crews on both ends of the caved-in material in both drifts, both lined drifts.

Q. Will you explain to the Judge how you had access to both ends of the caved-in material?

A. There are adits, your Honor, that go from one tunnel to the other, as indicated by the line at a distance approximately in 680 feet, apparently, from the west portal of the north tunnel.

The Court: Q. What is the distance across?

A. Approximately [654] 99 feet between the walls of the two tunnels.

Mr. Marrin: Q. An adit is a small tunnel connecting the two larger tunnels, is it?

A. Yes. In this case, it was 5 by 7 feet, approximately. That had been driven through prior to the accident, which gave the men the opportunity who otherwise would have been trapped in the forward part of the excavation which had been car-

(Testimony of Lewis Michael Larson.)

ried on to about Station 123 plus 40,—that is, about the face of the north tunnel,—at the time of the cave-in—which was, as a matter of fact, around Station 114 plus 00; that gave the men a chance to come out through that adit and through the south tunnel, and reach safety, and also made it a point in which men could go in again and resume work without being obstructed by the caved material. It gave me the opportunity to bring in men to attack this material from the east end, and other men in from the west end. I excavated the two lower drifts, as indicated, first; and then followed with the two drifts immediately above, and then two drifts immediately above the second drifts, or the third drift above subgrade. I carried that to an elevation of about 3 feet above the wall plate line. I should state, at this time, that the timbers had caved in for a distance of 57 feet. The posts and the wall plates had not come in, but were beginning to. The material evidently had come in so rapidly from the top that, before the side walls could collapse, the material had filled the tunnel and given support to these unsupported side timbers, the posts and the wall plates. My purpose in excavating to that point was to bind the wall plates in position and to further the development work to give me something definite on which to carry on my work. After the drifts had all been excavated through, I erected forms similar to those used in the first concreting of the two tunnels,—wooden forms, covered with

(Testimony of Lewis Michael Larson.)

metal. I erected the side walls, first, and [655] put a key in them, for the concrete to about a foot above the wall plates.

Mr. Tinning: Q. How high would that be?

A. That would be approximately 20 feet—between 19 and 20 feet. There, the usual construction key was put in, for concreting the arch later on. While that concreting was being carried on, with part of the crew, I drove that top drift over the loose muck. I should state this, in advance: that the remaining timbers that had not collapsed but were at the point of collapse, were all supported by posts that were carried from those timbers down to this fill material that had fallen in the tunnel; this fill material was all the time compacting; as it was compacting, the timbers from above that were weakened were falling down. It was necessary, realizing I would have to find new support on this settling core, or material that was in the tunnel, to drive my top drift higher, carrying it probably 2 feet above the outer concrete line. That was all going fast. Sometimes, I held it; and sometimes, I failed to hold it. The settling continued, of course, as it transmitted the weight onto the timbers and the top segments; and, in this case, I increased that top segment from 12 by 12 inches to 14 by 14. I worked crews from the sides, driving that top drift. It was necessary, of course, in this instance, to drive spiling all the way over the top and on each side, because it was just a pulverized mass,—just like sand. When the two drifts were through, the minute the

(Testimony of Lewis Michael Larson.)

walls had been poured through the caved material, I began then working crews—First of all, I poured a ring of concrete from these walls adjacent to the timbers that were down, and giving support to the timbers that were at the point of collapse. That prevented the cave from spreading. It was also a safety to the men who would continue in the work; and, from this new concrete ring that was about 6 to 10 feet in length, the [656] new concrete arch resting on the side walls—that had a length with the tunnel—the length of the new arch. When that was completed, I started crews at the top drift, driving spiling downward. The cap that held those, normally, rested on one set of posts that were transmitted down to the core, and then, in turn, some foot blocks that were wide enough not to be crushed into this loose material. The other end of the cap was inserted into the concrete; this, of course, all above what we term the “pay line of concrete”; that is the 2 foot point above the inner edge of the lining. I established the distance of approximately 6 feet. My purpose in that was: the new material could be very heavy; it was just a broken mass above me of undetermined height; I have never checked the distance, but it was lying in sort of a crater, and it had collapsed in that condition; but, of course, being so very badly pulverized, it had no means of supporting itself in that position. Then, working on both sides of the cave, driving the spiling on the side adjacent to the material and up over

(Testimony of Lewis Michael Larson.)

the cap until I reached the concreted wall on each side; and I then stopped and put in my form segment for the concrete; put in the reinforcing steel, and poured concrete in on this new ring of about 6 feet in length, measured along the tunnel line, with operations alternating on the west side, then to the east side. As soon as it had been poured, I started crews excavating another 6 foot section driving spiling from the top, and repeated that operation until I had pinched off all the material, and everything was resting on the concrete.

The Court: Q. After you repeated that operation, was there a cavity left?

A. The cavity was partly filled, your Honor, with material that had got to the line,—the tunnel line, at the top, apparently. The cavity was about 15 to 18 feet deep. When material that is broken,—whether it swells, or whatever it does,—it [657] does not contract itself—and it is possible this cavity, later on, might be deeper; but that is as near as I could estimate this: about 15 to 18 feet from the normal elevation of the material.

Mr. Tinning: Q. Mr. Larson, I don't know if I am clear—You are referring to that at the surface of the ground above where the slide occurred in the tunnel,—some distance up, there was an actual crater on the surface?

A. That is the point I am trying to bring out.

Q. That was the point that was about 15 feet?

A. Yes. That was my estimate.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. There was no cavity left inside the tunnel—

A. No. That remained in a compacted condition. The material that was in there when it filled the tunnel had remained in a compacted condition.

Q. After you had completed the section, did you then remove the caved material?

A. Yes; we were set to remove the core.

Mr. Tinning: Q. Remove the core, did you say?

A. The new core of loosened material.

Mr. Marrin: Q. Were you required to leave the forms of concrete for some time before the core was removed?

A. As I recall it, the last pour that we made,—I mean, the pour that closed the aperture,—was about 5 days. I may be mistaken in a day or so.

Q. When did you commence this operation of removing the caved-in material?

A. On the 15th day of September, as I recall it; and completed it about—

Q. 1935?

A. 1935; and completed it about the 6th of December. That is my guess. I might state something, to clarify the situation a little bit: that the posts were removed from the caps that [658] I have mentioned, by putting in rails, carried the rails—what we termed “balled” them in; that is, two rails, with the flanges and balls nesting together, would be carrying from the cap down to the forms supporting the concrete.

(Testimony of Lewis Michael Larson.)

After the concrete lining was poured, we would burn those rails off, so there would be no projection below the inner finish of the concrete line, and leave a smooth surface. [659]

Q. Mr. Larson, did the fact that the timber could not be removed from the section of the tunnel which you excavated before the concrete lining was placed affect the cost? A. Yes, quite materially.

Q. In what way?

Mr. Wittschen: Objected to as immaterial, and particularly in view of the witness' testimony that in the first 720 feet he did not intend to remove the timbering, and has testified that his own plan originally contemplated leaving the timber in the first 724 feet of tunnel.

Mr. Marrin: I think he would be entitled to answer, your Honor, as to the effect on the cost of removing the timber. It will appear later that a great portion of this tunnel where he contemplated removing the timber he was not able to do so.

Mr. Wittschen: He quit and left the job before he ever got beyond the point where he intended to leave it in right from the start.

Mr. Marrin: He is qualified as an expert to answer the question.

The Court: I will allow it in subject to the motion to strike.

Mr. Wittschen: Exception.

A. It affected it in the material cost of the timber, first, in the framing cost, the transportation

(Testimony of Lewis Michael Larson.)

cost, and the erection cost. In my experience in tunnel construction I know of no case where timber in place is as cheap as concrete in place; consequently, where you had to put in timber it increases your cost; even if you had the lowest class of timber, it increases the cost over concrete which otherwise might have been used.

Mr. Marrin: Q. Would it also increase the size of the excavation required? [660]

Mr. Wittschen: The same objection.

The Court: The same ruling.

Mr. Wittschen: Exception.

A. Yes, it does increase it, because the timber has to be outside of the outer edge of your concrete.

Mr. Marrin: Q. During the time that you were employed by the plaintiff was the work delayed in any way by the action of the plaintiff?

A. Not that I know of, no.

Q. What is your opinion about that?

A. That it was not.

Q. That it was or was not?

A. There was no delay on account of the plaintiff.

Q. Mr. Larson, during the time that you were employed by the plaintiff did the company, or any of its officers, ever refuse to give you all of the equipment needed in connection with the work?

Mr. Wittschen: Objected to as immaterial, irrelevant, and incompetent, and self-serving.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: If your Honor please, I want to show that Mr. Larson had full opportunity, full authority to get all the equipment and all of the men that he needed in prosecuting the work. There is going to be a question involved, if your Honor please, as to the time, it is going to be very material, and we are simply producing this testimony to show that we used every effort to complete this tunnel within the contract time.

Mr. Wittschen: May I observe on that, they took a contract to build a tunnel within a certain time and supply all of the labor and material, and presumably that was their responsibility, and whether he was refused equipment or not would not make any difference; if they could not get labor that would not bind the defendant.

Mr. Marrin: There is a provision that provides that if in [651] the judgment of the engineer the plaintiff was delayed for any cause beyond his control he is entitled to an extension of time, which judgment, in our opinion, must be exercised fairly and impartially in view of the circumstances.

The Court: I will let you make a record on it, as I have heretofore ruled. I will allow the testimony to go in subject to your motion to strike, and an exception.

Mr. Wittschen: Exception.

A. They did not. I had a call on any equipment that I might have use for.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. Were you allowed to employ all the labor you needed?

Mr. Wittschen: The same objection.

The Court: The same ruling.

Mr. Wittschen: Exception.

A. I was allowed to employ all of the labor, but much of it was not competent labor.

Mr. Wittschen: I ask that that go out. They chose the labor, that was their responsibility.

The Court: It goes out.

Mr. Marrin: Was the labor competent labor?

Mr. Wittschen: Objected to as immaterial.

The Court: Objection sustained.

Mr. Marrin: Q. Did the plaintiff direct you to expedite the work as much as possible?

Mr. Wittschen: Objected to as self-serving, and leading and suggestive.

The Court: Objection sustained.

Mr. Marrin: Note an exception.

Q. In your opinion, Mr. Larson, in excavating the portion of the [662] tunnel which you excavated did you employ the best construction methods under the circumstances?

Mr. Wittschen: Objected to as incompetent, irrelevant, and immaterial, and asking for the opinion of the witness upon a matter which is self-serving, as far as the plaintiff is concerned.

The Court: I will allow him to make a record on it. I will overrule the objection subject to a motion to strike out.

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: Exception.

A. I did the best I knew how.

Mr. Marrin: I should like to introduce in evidence for illustrative purposes the poster on the easel which has no legend, but it is being introduced for the purpose of illustrating the lines and grades necessary in the construction of tunnels in this manner.

The Court: Let it be marked.

Mr. Marrin: I offer it.

(The poster was marked "Plaintiff's Exhibit 44.")

The Court: What does that diagram depict? Explain that in your own way.

Mr. Marrin: Explain what it shows.

A. That depicts first the grades and lines that are necessary for the proper progress of the excavation of the tunnel.

The Court: Q. Just indicate for the purpose of the record what that discloses.

Mr. Marrin: The witness is referring to Plaintiff's Exhibit No. 44.

Q. Will you explain, Mr. Larson, the lines and grades necessary to be used in the excavation of this tunnel?

Mr. Tinning: This diagram appears to be a diagram of a drift.

Mr. Marrin: This shows how a tunnel has to be constructed by the drift method.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: You have some models that show, they are a large [663] size.

Mr. Marrin: We have a model showing the full face method we hoped to use, but the testimony in this case will show that the tunnel had to be excavated by the drift method because of the condition of the ground.

Mr. Tinning: There were drifts for driving ahead of the open face.

Mr. Marrin: In excavating a tunnel, where you have to use the drift system, as we will show and also prove through this witness, it is necessary to check the lines and grades in the drift at the forward portion of the drift.

Mr. Tinning: That is what I wanted to get a statement from you on, as to what you were proceeding on—this is a drift.

Mr. Marrin: Certainly, and that is where the lines are set.

Mr. Tinning: That is your contention, that that is where they should be set. You asked him as to the method of excavating a tunnel. This is one of the drifts in his tunnel. That is what the diagram is.

Mr. Marrin: Yes, that diagram is a diagram of a drift.

Mr. Tinning: That is what I wanted to make clear for the record.

A. This illustrates, your Honor—

(Testimony of Lewis Michael Larson.)

Mr. Marrin: The witness is referring to Plaintiff's Exhibit No. 44.

A. (Continuing)—just one operation of a drift. There are several drifts and in each instance something similar would be necessary for line and grade. If it is considered a drift down below the wall plate something similar would have to be used so as to give its location. It covers, in a general way, what is required in the location of a tunnel by the drift system. In [664] order to make it clear, the men who are working excavating forward to get the right elevation or the right line, it is necessary that they have established in the immediate vicinity of their work lines from which they can get the distance in or out, lines which will give them the proper direction, grades that will give them the necessary elevation, so they will not go too high or too low. This section illustrates its need and the manner in which we generally use them in tunnel work. Now, often times a little movement of ground, the shooting of ground, if it offers resistance, where dynamite is necessary, a little displacement may cause misalignment of the lines that give direction, and consequently it is provided, and it is generally true, that you receive three lines, three points, so that in case one does not check with the other two that you can try to determine an approximate compromise or try to determine with other points further back which one of the lines may have been thrown out, and in that way give the workmen a

(Testimony of Lewis Michael Larson.)

chance to go ahead and excavate in the direction in which they should excavate; consequently we had points on what we term a cap where we can swing a weight that we term a plumb-bob; this plumb-bob may be a piece of rock. The line support may be a piece of wire or it may be a piece of twine, or anything else that will suspend and allow the line to suspend in a vertical position. These points are entirely necessary for the progress of the work, as I stated. The grades for the same reason. These grades are generally placed at the request of the superintendent in some position where they will be protected and we can pick up from and get the right elevation for setting our foot blocks for our posts, whether it be on the right-hand side or the left-hand side. I say in a protected position, because in the operations of the work, shooting and one thing or another, you may destroy them [665] if they are not placed there; if they are placed at some point by some means where they cannot be disturbed unless something of a major nature happens, they can be driven in by some form of spike like they use on a railroad track, only there is a little spike driven in the side of the post. That elevation is indicated by the engineer at the request of the superintendent at a certain distance above the foot block; that means 2 feet, 3 feet, 4 feet, or whatever in the judgment of the superintendent is the proper elevation. From that distance measured down we determine the elevation of the

(Testimony of Lewis Michael Larson.)

foot block; the posts are generally cut to an established length, and if you place the grade at the right elevation your cut is going to be at the right elevation. From the suspended line you get the distance out you must go in order to get your timber line and tunnel in the right direction. That illustrates only one of the operations. If you have 13 drifts you have to have that operation in 13, possibly, unless you can suspend your line down to one of the lower drifts. But that is something that we have to have every day in order to keep checking that there has not been a shift in the line, something that has to be run as your progress goes ahead, it has to be known to the men who are working, to see what they are doing, and make no mistakes.

Q. Referring to Plaintiff's Exhibit 44 and the diagram on the right-hand side, this point here which I am pointing to from which the hand projects represents what?

A. This is the excavated face of the drift. Now, I am putting up a post first of all; we run over here and establish the grade for our foot block. From the line we establish the distance out for that foot block. Now, we have established the direction and the elevation and the distance out for the foot block, and we know how far from that foot block [666] we are going to place the next foot block in order to give us operating room. We establish the

(Testimony of Lewis Michael Larson.)

top of our post in the same way with a necessary distance. If you establish your top and bottom you have the inclination of your post or the plumb of the post, whatever is required in the different directions you establish all of the drilling factors, and you are starting off then with a positive elevation and positive line.

Q. During the time that you were employed by the plaintiff were those lines and grades stated on Plaintiff's Exhibit No. 44 established in each of the drifts which were driven before the excavation proceeded? A. Not by the force of—

Q. I am asking you that question, were they established? A. They were not.

Q. Listen to the question I asked you. Will you please read the question?

(Question repeated by the reporter.)

A. They were established.

Q. Who established them?

A. Engineers employed by the Six Companies, paid by the Six Companies.

Q. Did the District during that time establish any of these lines and grades?

A. No, not that I know of. I am positive they established none in the drift.

Q. By the District, I mean the defendant in this case, or its employees. A. No.

Q. Did the District, to your knowledge, establish any lines and grades in the tunnels?

A. Yes, they did.

(Testimony of Lewis Michael Larson.)

Q. Will you describe what they did?

A. After the excavation was advanced a certain distance, an indefinite distance, they would follow up, giving us the center line and elevation at that point. They were follow-up lines, they were not advance lines. [667]

Q. How far back were those lines usually from the core of the tunnel which was being excavated?

A. I will have to give an estimate of that. I should say approximately all the way from 100 to 300 feet.

Q. Would those be sufficient lines and grades for you to work to in constructing the tunnel?

A. Decidedly not. To work to they had to be where we were working, they had to be in a forward position, not in a backward position.

Q. Do you know, Mr. Larson, what is ordinarily referred to in the construction industry as contractors engineering?

A. Yes, I do.

Q. What does that mean?

Mr. Wittschen: I object to that as immaterial, irrelevant, and incompetent, and asking the witness first to endeavor to interpret the contract, and, secondly, asking him to give a definition in general terms which is not binding upon the defendant.

Mr. Marrin: The object is this, there is a provision in the specifications which I think has been read before. It is subsection (s) under Section 6 on page 7, which is entitled "Lines and Grades." It says, "The contractor is to furnish free of charge

(Testimony of Lewis Michael Larson.)

all stakes necessary for marking and maintaining points and lines given by the District Engineer; and shall give the District Engineer such facilities and materials for giving said lines and points as he may require, and the District Engineer's marks must be carefully preserved. Sufficient points to line and grade will be set for the contractor to work to and no additional stakes will be set. Any such stakes or marks lost, damaged or obliterated shall be replaced at the expense of the contractor. The contractor shall do his own engineering and shall be responsible for the completion of the work to proper lines and grades in conformance with the stakes set by the District Engineer. The District Engineer shall be furnished facilities for the checking of lines, elevations, [668] grades and forms at all times during the progress of the work. The contractor shall, without charge to the District, provide openings for and suspend work that will in any way interfere with the surveys, at such times and for such periods as the District Engineer may deem necessary." Now, in order that Your Honor may understand the meaning of this, I will say that early in the performance of this contract the plaintiff demanded of the District Engineer, and which will be fully proved, and kept on demanding for months that the District Engineer set sufficient lines and grades in these drifts for the contractor to work to. The District Engineer took the position

(Testimony of Lewis Michael Larson.)

that this provision of the specifications which said that the contractor shall do his own engineering requires the contractor to do all that work. As we view it it was a condition precedent to the contractor's obligation to perform, which work should have been done by the District. Now, the term "contractors engineering" as used in the construction industry is of the nature of a technical expression and we want to produce witnesses to testify as to the usually accepted meaning of that phrase so that your Honor may have the benefit of knowing and deciding in this case what meaning it would have to a man familiar with the usages in the construction industry.

Mr. Wittschen: We do not object to this witness stating that the District did not do certain things. The term "contractors engineering" is not being used. It said that the contractor should do his own engineering. The question now is asked of this witness to interpret something that is not in the specifications, what is known by the term "contractors engineering". These specifications state that the contractor will do his own engineering and your Honor will ultimately have to construe what this means, but I do not [669] think that a witness called by one party has the right to define a term that is not in the specifications.

The Court: You may, if you limit it to the language of the specifications, develop from this expert any thought that you have in mind.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. Mr. Larson, I will show you the specifications and ask you to look at this part of Section 6, subdivision (s) on page 7, and I will ask you to read that and state to me what obligation the contractor had under that provision of the contract, in your opinion?

Mr. Wittschen: Objected to as immaterial, irrelevant and incompetent, and calling for the opinion and conclusion of the witness upon a matter which is not the subject of expert testimony, and seeking to have the witness do something which should be done by the Court.

Mr. Marrin: That is Plaintiff's Exhibit 3.

The Court: I will allow the testimony in subject to the motion to strike.

Mr. Wittschen: Exception.

Mr. Marrin: Q. Will you read it first and then tell us what it means?

A. "The contractor shall do his own engineering and shall be responsible for the completion of the work to proper lines and grades in conformance with the stakes set by the District Engineer." Is that the extent that you wish?

Q. Yes, just read that.

A. My understanding of contractors engineering is that if the contractor wishes to have some change in the plans, in the method of constructing the concrete or some other detail, that he must apply to the District Engineer for the District Engineer's Approval; to show what he has in mind, that he

(Testimony of Lewis Michael Larson.)

must do his own engineering so far as the location of the plant, give the right lines and grades for it, the indication [670] of the equipment that he is going to use in the prosecution of the work. That is my opinion of that clause.

Mr. Marrin: Q. Is it your opinion that under that clause the contractor has an obligation to set those lines and grades for the construction of the tunnels?

Mr. Wittschen: Objected to as leading and suggestive and having been asked and answered. The witness was asked to construe the clause and did so, and counsel now is suggesting something else to him.

The Court: Read the question.

(Question repeated by the reporter.)

Mr. Wittschen: And all of the other grounds.

The Court: He may answer subject to the objection.

Mr. Wittschen: Exception.

A. It is my opinion that the contractor would not be required to do any of the work; that is a part of the owner's work.

The Court: Under your construction of this clause, what was not done? What did the engineer fail to do?

A. The engineer failed to give us points to work to that were necessary for us to carry on our work properly.

(Testimony of Lewis Michael Larson.)

The Court: Briefly indicate that for the purpose of the record so I may have some understanding of it.

A. Referring to Exhibit No. 44, none of the points that are indicated in this exhibit were given by the owner and were all given by the contractor. My understanding of the contract would be that these lines and these grades were an obligation of the owner and not the contractor.

Q. Was he to build that frame? A. No.

Q. How could he give those lines without constructing it?

A. We put up the frame and then after the frame is put up he [671] comes and puts the lines and grades on the frame that we have constructed; he checks them in case of possible movement.

Q. Very well. What does that operation involve, briefly?

A. The operation involves the employment of an engineer with an assistant who will pick up from some back point, giving a line to the engineer who has the instrument for projecting that line and then after the engineer has picked up from this point in the rear, or at some other point that may be chosen by the engineer, who has surveyed the point he could get the line into the several drifts on the frame that we have erected. The same applies to the grade in that his assistant will have to pick up the grade from some well established and positive point and carry that into the several drifts.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Q. Mr. Larson, is this a drift which has already been constructed?

A. That has been constructed in its present form and everything is noted in that drift except the grade and the lines, and they are to be supplied.

The Court: It is clear to both sides, is it not, what I am trying to develop? I just want to follow it. That is the reason I asked the witness, I do not want to mislead either side.

Mr. Marrin: I thought your Honor was a little bit confused when you asked the witness if they required them to construct the framework. I wish to simply bring out that that drift is in without noting the lines and grades to proceed to.

The Court: Let me say this off the record.

(Discussion off the record.)

We will take a recess now until Tuesday morning at 10 a. m.

(An adjournment was here taken until Tuesday, April 19, 1938, at ten o'clock a. m.) [672]

Tuesday, April 19, 1938.

Mr. Marrin: May it please your Honor, we would like to put a witness on out of order; his testimony will be rather short and I understand the other side has no objection.

The Court: Very well.

ALFRED JOSEPH ORSELLI.

Called for the Plaintiff; Sworn.

Mr. Marrin: Q. What is your business, Mr. Orselli? A. Civil engineer.

Q. Are you a graduate engineer? A. I am.

Q. Of what university?

A. University of California, Berkeley.

Q. When did you graduate? A. In 1927.

Q. During the years 1933 and 1934, were you employed by the W. A. Bechtel Company.

A. I was.

Q. Will you state when you entered the employ of that company? A. November, 1933.

Q. For how long thereafter were you employed by the W. A. Bechtel Company?

A. Until June, 1934.

Q. Continuously? A. Continuously.

Q. During the time you were employed by the W. A. Bechtel Company did you have anything to do with making estimates for bidding upon the project of Joint Highway District No. 13?

A. I assisted Mr. Larson in the preparation of his estimates by securing material quotations and making extensions of his estimates.

Q. And in checking his estimates?

A. And in checking his estimates.

Q. I show you a document marked "Report and Proposal Tunnel Proper, Broadway Tunnel Project of Joint Highway District No. 13," which also has on the cover page, "Engineering Development De-

(Testimony of Alfred Joseph Orselli.)

partment [673] Bechtel Kaiser Company, Ltd., 155 Sansome street, San Francisco, California, and ask you to tell me what that is.

A. This document—

Mr. Tinning: Just state what it is, Mr. Orselli.

A. This document is a recast of Mr. Larson's original estimate in the form required, or the recast of Mr. Larson's estimate as handed to me in the form required by the Bechtel interests.

Mr. Marrin: Q. Is the information in there the same or different from that contained in Mr. Larson's estimate?

Mr. Tinning: Just a moment, we object to the question on the ground that it does not call for the best evidence, in that the original sheets and documents that were handed by Mr. Larson to Mr. Orselli are the best evidence.

Mr. Marrin: I might explain, Mr. Tinning, that we have here the original sheets which Mr. Larson prepared and they are in the form of pencil notations, and are not in particularly intelligible form to the Court, and it is not our purpose to introduce those in evidence, because we think they will simply incumber the record. However, they are here available for your examination and available for your use upon cross-examination. The purpose of this testimony, your Honor, is to show, and we offer to show through Mr. Orselli, that he took these pencil notations of Mr. Larson's and his estimates, and recast them in the form required by the W. A. Bechtel Company; that thereafter changes were made and that this recast was revised and it

(Testimony of Alfred Joseph Orselli.)

was upon this revised recast that the bid of Six Companies of California was made; in other words, the purpose of this is to trace through and show the connection between Larson's estimate and the bid which was submitted by the plaintiff in this case to the defendant in this case. We are not offering this particularly for the purpose of [674] proving the details of these figures, but to show that the final bid was substantially the same as Mr. Larson's estimates. That is the purpose of this testimony.

Mr. Tinning: We think that we are entitled, in tracing this through—I may not understand Mr. Marrin, but we think that we are entitled in the tracing of this matter through to have each of the documents that finally resulted in the bid; in other words, that we have Mr. Larson's sheets, that we have then what Mr. Orselli did with them, and then if they were recast I think logically that would be the next step.

Mr. Marrin: That is exactly what we propose to do.

Mr. Tinning: If I understand your statement you do not propose to introduce the original sheets of Mr. Larson.

The Court: Subject to your check if any attempt to digest is offered here; I take it that the original sheets are here and may be examined in detail. Do I follow you?

Mr. Marrin: That is correct, and they may introduce them in evidence if they desire.

(Testimony of Alfred Joseph Orselli.)

Mr. Tinning: In other words, we do not know what support there is to this because we have not examined the supporting documents and we are not in a position to stipulate. We do not question that you made some kind of a recast, but we do not care to stipulate to some document which is not supported by other documents.

Mr. Marrin: I am not asking you to stipulate to it or to the truth of any of the statements in it. I am merely asking this witness to identify and explain what it is, and then I propose to offer it in evidence.

The Court: As a legal matter I will sustain the objection, the objection is good. [675]

Mr. Marrin: Upon what ground?

The Court: The legal ground is good, namely, you have a digest here from some original sheets. They ask for the best evidence, and, under the rule, they are entitled to it. If they insist upon the objection the Court will sustain the objection.

Mr. Marrin: Do you insist on the objection?

Mr. Tinning: Yes. It is not to embarrass you, but we simply feel it is a necessary part of the case.

Mr. Marrin: It is not exactly a digest of it, your Honor, it is a recast in form.

The Court: You might offer the recast, but he is entitled to the original under the rule; he has called for the best evidence.

Mr. Marrin: In that case I presume we had

(Testimony of Alfred Joseph Orselli.)

better withdraw this witness temporarily and put Mr. Larson on.

The Court: Maybe after he examines this he will not object. I don't know what is contemplated.

Mr. Tinning: We do not know either. We have not seen it yet.

The Court: After you examine it probably you may get in accord on the presentation of it. I don't know.

Mr. Marrin: Q. Mr. Orselli, I show you here a file of pencil notations and figures and ask you if you can identify that and tell me what that is?

A. The file of pencil notes and papers herein are the original sheets prepared by Mr. Larson, passed to me for basing an estimate on the Broadway Tunnel proper.

Mr. Marrin: We now offer these in evidence.

Mr. Wittschen: We object to them on the ground that they are immaterial, irrelevant, and incompetent, cannot in any way change the original contract with the parties, and that the ultimate figures are those in the bid of the plaintiff in this case, and any preliminary figures tend to prove no issue.

[676]

Mr. Marrin: They are not offered for the purpose of varying the written contract in any respect. They are offered for the purpose of showing that Mr. Larson, as he has already testified, relied upon the geological reports, specifications and other matters in making this bid, and showing through this

(Testimony of Alfred Joseph Orselli.)

witness that the figures which Mr. Larson submitted were used by this plaintiff as the basis for the bid on this contract. There is no purpose to alter the contract or alter the amount of the bid, at all. It is simply a matter of connecting Mr. Larson's reliance with the bid which was made by this plaintiff.

Mr. Wittschen: The final figures submitted speak for themselves.

The Court: Is the matter submitted? I want both sides to protect the record.

Mr. Marrin: Yes.

The Court: The objection will be sustained.

Mr. Marrin: Note an exception, your Honor.

Mr. Alexander: We join in the exception, your Honor.

Mr. Marrin: I assume your Honor has ruled on this matter, but I would simply like to draw your attention to the fact that you did permit Mr. Larson to testify respecting this estimate, and this is simply confirmatory of the fact that he did make this estimate and turned it over to the plaintiff in this case.

The Court: That is his estimate and he turned it over to the witness on the stand?

Mr. Marrin: Yes.

The Court: Q. What was the purpose of doing that, if you know?

A. For the purpose of recasting it in the form required by the Bechtel interests.

Q. What was that purpose?

(Testimony of Alfred Joseph Orselli.)

A. For the intelligent presentation [677] of Mr. Larson's estimate in a form in which the Bechtel interests will understand it.

Q. And it was in preparation for making a bid on this work? A. Oh, yes.

The Court: You will have to stand on the bid. I will allow any reasonable latitude in reference to the thing that counsel suggests; whether they were misled by the geology or what not I am not prepared to say.

Mr. Marrin: Do I understand your Honor's ruling is that the plaintiff will not be permitted to connect up Mr. Larson's reliance with the plaintiff's bid in this case?

The Court: Mr. Larson is here and can testify as a witness and having his figures passed on to a third party, how will that corroborate it? There is no doubt about the bid figures, is there?

Mr. Tinning: No.

Mr. Marrin: But in arriving at the bid we had to go on someone's figures, and someone's prepared method. We are proposing to show that this plaintiff relied and acted upon Mr. Larson's figures as to costs and upon his proposed method as to procedure. Now, we propose to show that he turned it over to Mr. Orselli and he revised it so that it would fit in with the form of estimate that is ordinarily used by the W. A. Bechtel Company, that it was then turned over to the president and

(Testimony of Alfred Joseph Orselli.)
representative of the plaintiff in this form as prepared by Mr. Orselli, was slightly changed by them, and that their bid was based upon this estimate which was made by Mr. Larson. As we see it, we must show that connection, and this testimony is offered for the purpose of connecting up this bid with Mr. Larson's estimate.

The Court: I have in mind the record, and I am inclined to limit this record to the point where I am not misleading either one [678] side or the other; as to the question of law in the presentation of the case, I have some fixed state of mind; in fact, I do not want to preclude you from having a record in the event I am in error about the law in regard to this position. Now, the theory of presenting this evidence has to do with the geologist's report?

Mr. Marrin: It has to do with this. Mr. Larson already testified, as you will recall, to some extent that he relied upon the geological report and plans and specifications in making his estimates. Now, there is nothing, so far in this record to show that this plaintiff adopted and relied upon Mr. Larson's estimates in making its bid. The purpose of this testimony is to show Mr. Larson did prepare a bid, that he submitted it to the representative of this plaintiff, and the plaintiff used those figures and those methods as a basis for submitting its bid; in other words to show that its bid on this contract was made in reliance upon Mr. Larson's work. That is the purpose of this offer of testimony.

(Testimony of Alfred Joseph Orselli.)

The Court: I am prepared to give you a wide latitude and reasonable opportunity for presenting your theory of the case. I am in doubt as to what the proper method to follow is. I would not even suggest to you in presenting this case that you put a witness on the stand on the geological report or that some other evidence be offered and presented. I have in mind in discussing this matter that I have an open mind on all of these matters, and I want to give both sides the benefit of it without misleading them to their injury.

Mr. Marrin: Surely, your Honor, and here are the facts of the situation. Mr. Larson was the man who was employed to and did make the estimate, as is shown by his testimony; he then turned his information over to others who made the final compilation of the bid from his estimate. Now, if we must stop with Mr. Larson we are left suspended in mid air. [679]

The Court: I have that in mind.

Mr. Wittschen: Might I suggest that the final man who put in the bid—I will object to the evidence because I do not think it is material, but he can say that he relied on Larson's figures and he could get it without going through all the detail figures.

The Court: That is what I had in mind. Your theory of the case is whatever the facts may be he will have an opportunity to check them.

(Testimony of Alfred Joseph Orselli.)

Mr. Wittschen: Whoever put the bid in can tell you they relied on the report of Mr. Larson, and I will object to that as immaterial, but that will be the ultimate fact you are entitled to prove.

The Court: As a matter of law I agree with counsel at this time. I may be in error, but I want to give you a record.

Mr. Marrin: Surely. I feel very strongly that it is necessary to have the testimony to show what Mr. Larson's estimate was and to show that the plaintiff in this case relied upon it.

The Court: I think it might be helpful if you withdrew the witness on the stand and called your geological expert and then make an offer of all of this testimony at the proper time. I want to give both sides an opportunity to present their theories of the case and have a record in the event that I am mistaken about my views.

Mr. Marrin: Surely, your Honor. Before I withdraw this witness I would like to make an offer of proof for the record. We offer to prove through the witness on the stand that the estimate of the costs and methods of doing the work described in the contract between the plaintiff and the defendant, made by Mr. Larson, were delivered to this witness, who was then an employee of the W. A. Bechtel Company, and that this witness then made a recast [680] of Mr. Larson's estimates, simply for the purpose of changing the form; that this recast was then submitted to S. D. Bechtel, President of the Com-

(Testimony of Alfred Joseph Orselli.)

pany, at a conference between him and Mr. Hindmarsh——

The Court: Who was he?

A. He was an employee of W. A. Bechtel Company, and Mr. Fontaine, at which conference certain changes in Mr. Larson's estate as recast by Mr. Orselli were made. We offer to show the changes which were made. We further offer to show that this witness then made the changes which were discussed and agreed upon at that conference and that Mr. Larson's estimate, with those changes, was adopted as the basis of the bid of the plaintiff in this case for the contract which was entered into between the plaintiff and the defendant.

The Court: How would the defendant be bound by anything that might have happened there.

Mr. Marrin: It is not a question of binding the defendant, as I see it, your Honor, it is a question of showing the reliance of this plaintiff upon Mr. Larson's estimate. It is a question of fact, did the plaintiff, or did it not, rely upon the estimate which had been made by Mr. Larson? That is not a matter which in any way changes the contract or the specifications. We are making no attempt to do so. We are attempting to prove the fact of Mr. Larson's reliance upon the geological report and specifications in making the estimate, and, secondly, the reliance by plaintiff upon the work done by Mr. Larson. It is a matter of connecting it up. We offer to make that proof through this witness at this time.

(Testimony of Alfred Joseph Orselli.)

Mr. Wittschen: To which offer we make objection on all of the grounds heretofore made, and on the further ground that the ultimate figure in the bid and not the process of arriving at [681] the bid bound the parties.

Mr. Marrin: The ultimate figures in the bid do not disclose anything with reference to what that bid was based upon.

The Court: Is it conceded that this recast in the manner set forth had to do entirely with the Bechtel Company?

Mr. Marrin: No. I might state, in order that you may understand it, the initiation of the work of making this estimate was done by the W. A. Bechtel Company in association with five other associates at the time they started the work.

The Court: I understand that, but who of the defendants were in the meeting?

Mr. Marrin: None of the defendants were in the meeting. We are not attempting to bind them by any conversation or anything of that kind. We are simply trying to show what was done in making up this bid.

The Court: The Court will sustain the objection at this time.

Mr. Marrin: Note an exception.

Mr. Alexander: We join in the exception, your Honor.

Mr. Marrin: We will withdraw this witness. Mr. Larson, will you take the stand, please?

LEWIS MICHAEL LARSON,

Direct Examination (Resumed)

Mr. Marrin: Q. Mr. Larson, I show you here certain pencil notations and ask you if you will identify those. [682]

Mr. Marrin: Q. Will you state what those are, Mr. Larson?

A. With the exception of these sheets, this comprises the papers on which I recorded my estimate on the Broadway Low Level Tunnel.

Q. That is the estimate to which you have testified, in previous testimony, Mr. Larson?

A. It is.

Mr. Marrin: I offer that in evidence.

Mr. Wittschen: To which we will object, on the ground it is incompetent, irrelevant and immaterial; self-serving, as far as the plaintiff is concerned; and not binding on the defendant.

Mr. Marrin: For the sake of the record, I would like to make an offer of proof, your Honor, and state that we offer to prove, through this witness and by this evidence, the estimate by Mr. Larson made on the cost of doing this work and his reliance upon the statement in the plans and specifications and the geological report in making that estimate.

Mr. Wittschen: We add the further objection that that is all merged in the bid itself.

The Court: The objection will be sustained.

Mr. Marrin: Exception.

(Testimony of Lewis Michael Larson.)

Mr. Alexander: We join in the exception, your Honor.

Mr. Marrin: You may cross-examine.

Cross Examination

By Mr. Tinning:

Mr. Tinning: Q. Mr. Larson, were you ever employed by the W. A. Bechtel Company before February 25, 1934? A. I was not.

Q. Were you ever employed, prior to that time, by any of the remaining organizations which later formed Six Companies of California, the plaintiff in this action?

A. I had never been employed by any of the members that formed that group.

Q. How long, after February 25, 1934, were you continuously employed by either the W. A. Bechtel Company or the Six Companies [683] with which they were merged in the doing of the work on the Broadway Tunnel?

A. I was employed by the W. A. Bechtel Company until after the submission of the bids to the Joint Highway District for the Broadway Tunnels. I believe my transfer from the W. A. Bechtel Company to the Six Companies was about the 28th of May; that is my recollection.

Q. About that time, they knew and you knew they were low bidder on the job?

A. That is correct.

Q. How long were you engaged in making your estimate in this case for the bid?

(Testimony of Lewis Michael Larson.)

A. Possibly a total time of two months. That was interrupted by other estimates. There is a reason for my qualifying that statement.

Q. When you say "other estimates," you mean estimates on other jobs? A. That is correct.

Q. So that you started somewhere around the 1st of March—the 25th of February, I believe you gave us as the date, and continued two months, to about the 1st of May.

A. Until the —until probably the 28th of May, with the W. A. Bechtel Company.

Q. No, Mr. Larson. I was now directing your attention to the time you spent in the preparation of your estimate. I believe you stated you arrived in Oakland on the 27th of February, 1934, and started immediately working on your estimate; and it took you about two months to prepare the estimate,—to complete the estimate?

The Court: During that period, he did other work,—that is, estimated on other work.

The Witness: A. That is correct.

Mr. Tinning: Q. Therefore, you did not spend two months continuously in the preparation of this estimate?

A. May I enlarge on that a little bit?

Q. Would you mind answering "Yes" or "No," first?

A. Approximately [684] two months spent on this estimate.

(Testimony of Lewis Michael Larson.)

Q. How much time did you spend on making other estimates during that period?

A. Between February and May,—is that the intent of your question?

Q. Well, you say “two months approximately to prepare the estimate for the Six Companies”?

A. Yes.

Q. Was that a continuous employment, or did that preparation cover more than two months of the calendar?

A. It was interrupted.

Q. How long was the interruption?

A. As I recall it now, there was an interruption of almost a month.

Q. During what period was that,—the interruption?

A. My recollection is, now, that it was about the 28th of March until somewhere around the 20th of April.

Q. What were you doing during that period?

A. I was estimating the Fort Peck Tunnel, Montana.

Q. Were you in Oakland or San Francisco while you were making the estimate of the Fort Peck Tunnel?

A. I went to Fort Peck, surveyed the site, and did some of the estimating, on the train, on my return; and in San Francisco, the major part of the estimating was made. This was followed by an estimate of the Figueroa Street Tunnel. The whole period of time, as I can recall it, was approximately a month that was spent on other work.

(Testimony of Lewis Michael Larson.)

Q. Then you came to Oakland about the 25th or 26th or 27th of February, 1934, and you left about the 20th of March, and then went East to the Fort Peck Tunnel, and then came back to San Francisco and worked on the estimate for the Fort Peck Tunnel, and then went to Los Angeles to estimate the Figueroa Tunnel? A. That is correct.

Q. Was that for the W. A. Bechtel Company?

A. Under the same employment. [685]

Q. Under the same employment?

A. That is correct.

Q. When you completed your work on these other two estimates, you then directed your attention again to the Broadway Low Level Tunnel estimate? A. I did.

Q. When did you conclude your work on the Broadway Low Level Tunnel estimate?

A. Shortly before the bid was entered; possibly a week; that would be some time about the 15th of May, is my recollection.

Q. You testified, last week, that you prepared various parts of your tunnel bid, or tunnel estimate, on sheets of paper which you delivered to Mr. Orselli and other employees of the W. A. Bechtel Company. Were those all delivered at one time, or were they delivered as you finished your work on each sheet?

A. As I finished my work on each sheet.

Q. Were any of those sheets delivered by you to anyone at the time you left this work, about the 20th of March, and took up the Fort Peck Tunnel estimate?

(Testimony of Lewis Michael Larson.)

A. They were all delivered——

Q. Mr. Larson, the question is: Were any delivered by you to anyone prior to March 20th, or whatever date it was that you left and went on the Fort Peck estimate? A. Yes.

Q. Some had been delivered before that time?

A. They had.

Q. Were other sheets prepared by you for this estimate on the Broadway Tunnel some time around the 20th of April?

A. It is difficult for me to give you a "Yes" or "No" reply to that, for the reason I can only recall from memory that I had substantially finished the estimate on the Broadway Tunnel,—that is, I had given a rough total; and then, from those sheets delivered to me, I had completed a finished total, or a more studied answer to the different problems.

Q. That finished total that you refer to: was that something you did before you went away, about March 20th?

A. No. I arrived [686] only at a relatively close result of what the total would be.

Q. Mr. Larson, I think that is quite—I am trying to make this plain. I am asking if that more finished total, to which you just referred, was prepared before March 20th or afterwards, when you came back from the other work.

A. After March 20th.

Q. So that, during the period from March 20th until April 20th, when you were away, these sheets

(Testimony of Lewis Michael Larson.)

were all given to Mr. Orselli or some other employee of Mr. Bechtel's Company, during that interruption when you were away from the work?

A. To the best of my knowledge, they were.

Q. During that time, as I understand it from you, more finished estimates—the material quantities, were secured,—that is, the cost of cement and other things that went into the work; they were added in to your estimate; is that correct?

A. Progressively, as those items came in, yes.

Q. Well, you were not there during the period those items were coming in, though?

A. A good part of the time I was.

Q. What was the condition of your estimate on March 20th? You said it was partly finished; you had a rough total. Were there any material quantities in your estimate when you left on March 20th?

A. The estimate, in regard to weight—I figured the weight, for example, of the flues; and I take off different quantities, and I estimate the number of pounds.

I know about the prices various manufacturers charge for various articles.

Q. You determine that from your experience, and you attribute, from that judgment which you exercise, prices that those various materials will cost that go in to the estimate?

A. Yes, that is true; and, from that, I arrived at what we term a rough total. [687]

Q. When you arrived at that rough total, that was wholly on your own work and the sheets which

(Testimony of Lewis Michael Larson.)

you finished were wholly prepared by you?

A. Entirely so.

Q. Before you left, about March 20th, was anything added to those sheets or to the estimate, by any person other than yourself?

A. Not to my knowledge.

Q. Then, when you came back a month later, you found the data,—the quotations on the various materials that were required for the performance of the work, such as cement, timber and iron, and many other things that went into the work?

A. I found some of them, but not all.

Q. Not completed at that time?

A. No; not completed.

Q. In other words, you still had to make this final rough estimate which you prepared; you had to get further material prices?

A. That is correct.

Q. How long after you came back, did you complete the assembling of that data?

A. I think it was completed about the 15th of May, so far as my direct contact with it was concerned, although there may have been certain material prices that had not been received.

Q. When you concluded with the estimate on May 15th, there were still certain items for the cost of various materials that must be received and incorporated in the final figure?

A. Yes. They were receiving different quotations from different people, and some were slow in making their answers.

(Testimony of Lewis Michael Larson.)

Q. The last time you had to do with the estimate was about May 15th?

A. The last time when I entered anything into my estimate was about May 15th.

Q. When was the meeting with Mr. Hindmarsh and Mr. Bechtel; what was the date of that?

A. I am not prepared to answer that, because [688] my memory is defective; but I think it was about that same time, as near as I can recall.

Q. Mr. Larson, did I understand you to say that your memory was defective?

A. In telling you on certain dates, yes, extending back four years.

Q. After you undertook your work for Six Companies, about the 28th of May, 1934, how long did you continue in the employ of the Company, continuously?

A. Until the 30th of April, 1935.

Q. Did you resume employment for the plaintiff after that date,—April 30th, 1935?

A. I did.

Q. When, Mr. Larson?

A. As I recall it, it was about the 15th of September.

Q. How long did your employment last at that time?

A. My recollection is that it was until the 1st of December, 1935.

Q. You came on the job, did you not, the day following the slide that occurred on the night or the evening of August 28, 1935?

A. I did.

(Testimony of Lewis Michael Larson.)

Q. You say, now, you think you were employed about the 15th of September. Weren't you employed immediately following the slide?

A. I was employed by the legal department.

Q. You were employed by the legal department?

A. Yes.

Q. That is the legal department of the plaintiff Six Companies?

A. As I understand it.

Q. How long did you remain in the employ of that Company,—the legal department?

A. Only two or three or four days, as I recall it now. It was not long; it was merely to make a survey of the conditions.

Q. That was August 29th?

A. August 29th.

Q. And the employment lasted three or four days; and then did that employment cease?

A. It did. [689]

Q. For the Six Companies altogether, at that time?

A. I have no recollection, after that time, of having any direct association. I was in conference with Mr. Hindmarsh during that time, however.

Q. Then, on the 15th of September, you went back with the Six Companies, engineering department, under a regular employment?

A. That is correct.

Q. And you were engaged in what I think you call "recovering the Tunnel"; that is, taking out the slide?

(Testimony of Lewis Michael Larson.)

A. Yes; that is the portion that had caved in.

Q. Yes, the portion that had caved in. From September 15th until about December 1st, your time was given to that work,—the recovering of the Tunnel, the removal of the material that had caved into the Tunnel; and did you have anything to do with the placing of the concrete, the retimbering in the portion of the Tunnel where the cave-in had occurred?

A. I did whatever was necessary in that portion, including the lining of that section of the Tunnel.

Q. So that, in recovering the Tunnel,—to make it fully clear,—you, afterwards, had charge of removing the caved in material, removal of the debris, and the timbering of a section of the Tunnel that had been impaired by the cave-in, the restoration of the timbering, the construction of the forms, and the pouring of the concrete in the forms?

A. That is correct.

Q. And that required from about the time you started on the 15th of September? There had been some work prior to the 15th of September, with respect to the removal of the bodies of the men who were killed in that accident?

A. Yes.

Q. But, beyond that, the work was very much the same on the 15th of September; the condition of the work to be done was very much the same as it had been immediately following the accident?

A. I believe it was. [690]

Q. When you finished your work about the 1st of December, 1935, for the Six Companies, you had

(Testimony of Lewis Michael Larson.)

completed all of the work that was necessary to construct the main concrete arch in the portion of the tunnel that had been affected by the slide?

A. Everything except a little finishing of the lining of what we term "pointing up."

Q. Would you tell us what that is,—"pointing up"?

A. In carrying the weight of the tunnel down to the core, I had substituted rails, and taken out the timbers; those rails, later on, were burned off, back of the inner face of the lining; the pointing up means a covering over of the exposed rail. That was not quite completed.

Q. In other words, you used iron rails, or steel rails, as stulls? A. That is the point.

Q. Through the wooden forms which were installed in this section of the tunnel that was affected by the cave-in? A. Yes.

Q. You covered those holes with cement?

A. That is correct.

Q. After the 1st of December, 1935, when were you again employed by the Six Companies of California?

A. I have forgotten the exact date; possibly other people could supply that better than myself.

Q. Well, you have done pretty well so far. Let's have a little memory exercise.

A. I think it was in October of 1937.

Q. October, 1937. That would be last October?

A. Last October; that is my recollection.

(Testimony of Lewis Michael Larson.)

Q. Were you employed by the engineering or the legal department of the Six Companies last October?

A. By the legal department.

Q. During the ~~short~~ employment you had with the legal department in 1935, what did you do?

A. I was doing a little mining work for myself.

Q. You did not understand my question, Mr. Larson. I asked you not to state the type of employment you were following during your work [691] for the legal department; but what the actual work was that you did.

A. May I have that question read?

(Pending question read by the reporter.)

The Witness: A. Does this cover the period in October——

Mr. Tinning: Q. From the 29th of August, for the three or four days you stated you worked for the legal department.

A. To look at and report the conditions, as I found them in the Tunnel, and outside of the Tunnel, that would affect the work in the Tunnel, and safety of the construction.

Q. By that, you mean you inspected the timbering in the Tunnel, as it stood at that date; the condition that it was in; the excavation in and around the timber; the strain or stresses that might show in the timbering; and, during those four or five days, did you make any measurements of the portion of the timbering that may have intruded in that area required by the concrete?

(Testimony of Lewis Michael Larson.)

A. Not during that period.

Q. In other words, your report was a general report, based upon your knowledge as an experienced tunnel man, as to the conditions you found in the Tunnel immediately following that cave-in?

A. That was the objective.

Q. Did you make a written report on that, Mr. Larson? A. I did not.

Q. To whom did you talk?

A. I talked to Mr. Tom Price. I think I talked to Mr. DeLancey Smith, and to Mr. Hank Lawlor. I believe I talked to nobody else—not that I can recall.

Q. You made no written report of any kind at that time? A. No; just a verbal report.

Q. Did you ever make any written report on that observation?

A. I made notes on that observation that are used for making my verbal report. [692]

Q. Did those notes include references of your observation as to the condition of the timber in the Tunnel? A. I think they did.

Q. Did they also record the places that—or the sections within the tunnel, at which concrete had been poured?

A. I don't think so. I don't think I took the station numbers of that, because that was obvious.

Q. Were there any notes in there showing how long it had been from the time that the concrete lining had been last poured in the tunnel up to the date of that?

(Testimony of Lewis Michael Larson.)

A. No; because I was not familiar with that phase of it, myself. Some pouring had been done while I was absent.

Q. Well, are you prepared to say, now, approximately how much pouring had been done while you were absent?

A. It would have to be an estimate, only. It would not be absolute.

Q. Well, what, in your opinion, was the amount of concrete lining that had been placed after you left on April 30th?

A. I think, about 80 feet in the north tunnel, from the point where I had lined the first 110 feet; in the south tunnel, possibly two or three hundred feet; that is all an estimate,—just a rough estimate.

Q. Your idea is, now, there had been two or three hundred feet of concrete poured in the south tunnel after you left the work on April 30th and before you returned to it on August 29th?

A. That is my recollection now; I am not sure as to the accuracy of that recollection.

Q. Well, it is your best recollection?

A. Yes.

Q. And in the north tunnel,—the tunnel which you had been in charge of, driving,—that there had been about 80 feet of lining poured?

A. Yes. I am more definite on that, because I know where I had been pouring; that was why my memory is better on it. [693]

Q. That was the tunnel where the slide occurred?

A. That is.

(Testimony of Lewis Michael Larson.)

Q. After you returned to the employment of the legal department of the Six Companies, in October, what has your occupation been?

A. To assist in taking from the Six Companies' records such information as is necessary to form an accurate conclusion of the rate of excavations, the amount of concrete poured, and the number of days' delay; therefore, helping to set up for the attorneys such information as may be necessary and useful for them to have.

Q. Where were you employed after you left the Six Companies of California, the plaintiff in this action, on December 1, 1935, at the time that you finished recovering the caved-in tunnel?

A. Now, getting back to mining, I was working for myself.

The Court: We will take a recess.

(Recess) [694]

(After recess:)

Mr. Tinning: Q. Mr. Larson, you said you left the employ of the Six Companies in the fall of 1935, in December. Did you have any other employment in connection with the tunnel by anyone prior to your going back to the legal department of the Six Companies in October, 1937?

A. Not that I recall; I am sure I had not.

Q. Did you prepare any estimates for any contractor who either bid or considered bidding on the reletting of the work after the Six Companies quit?

A. I did.

(Testimony of Lewis Michael Larson.)

Q. How many estimates did you prepare for contractors who were bidding on the work?

A. I prepared two that were used.

Q. How many that were not used?

A. One.

Q. For whom was the estimate that was not used prepared?

A. I did not have any definite connection at the time. I made the estimate, as is often the case, being unemployed.

Q. Whom did you make it for?

A. Myself.

Q. You made it for yourself? A. Yes.

Q. At what time did you make that estimate?

A. Immediately after the District first called for bids, that date I am not sure of now; you can probably supply that.

Q. That was September, 1936, September 11?

A. Yes.

Q. Did you give the estimate that you made in September, 1936, to anyone? A. I did not.

Q. Did you communicate it to anyone at that time? A. I did not.

Q. How long did it take you to prepare that bid thereafter?

A. I think about a month, as I recall it now.

Q. About a month? A. Yes.

Q. So that for about a month previous to the time, the date on which bids were called for the completion of the Broadway Low Level [695] Tun-

(Testimony of Lewis Michael Larson.)

Q. Did you occupy yourself without compensation by anyone in the preparation of the bid for the completion of the work? A. I did.

Q. Have you that bid or that estimate?

A. I have only a summary of it.

Q. Where were you working when you made the estimate, where was your office?

A. In the Sequoia Hotel here in the City.

Q. What was your purpose in making an estimate of that kind, Mr. Larson? Did you have in mind that you might find some contractor who would pay you for the estimate, someone who might be considering a bid?

A. I felt reasonably sure that I could form some sort of an association.

Q. So that this was not a gratuitous month spent by you, just for curiosity, but you thought you were doing something for which you might be compensated if you found a contractor who wanted it?

A. Yes, directly or indirectly.

Q. That is, by employment, you mean directly or paying you directly for the work that you had done? A. That is correct.

Q. Did you offer that to anyone?

A. I did not.

Q. Did you contact anyone or discuss the fact that you had made an estimate with anyone prior to the time bids were to be received under the District call in 1936?

A. I think I mentioned it to Mr. George Pollock, though I am not sure of that.

(Testimony of Lewis Michael Larson.)

Q. In that estimate that you prepared at that time, prior to the first date on which bids were called in 1936 by the District, did you prepare an estimate of anything other than the work in the tunnel?

A. Yes, I did.

Q. What did the bid for this work call for?

A. My recollection is the bid called for everything that was left uncompleted by the Six Companies.

Q. In other words, the first call for bids, and my memory is correct, [696] that date was September 11, was for the entire job?

A. Yes, uncompleted work.

Q. That date was September 11, 1936, my memory is correct on that? A. Very well.

Q. You prepared then in your estimate the cost of the outside work, that is, what remained to be done, of the highway structures from Keith Avenue and Broadway, some two and a half miles up to the mouth of the west portal of the tunnel, and the remainder of the highway to be done on the east portal in Contra Costa County, the completion of the ventilating buildings at both the east and west portals, and those matters that went to the completed project from the point where it had been left by the Six Companies on June 13, 1936? A. Yes.

Q. What did you use as a basis of your estimate for the completion of the ventilating buildings?

A. I called on the people who had formerly had the contract with the Six Companies to get a quota-

(Testimony of Lewis Michael Larson.)

tion from them; they were prepared to give it to me, but I learned at that time that there would be no bid submitted by any contractor, and consequently when they offered it to me I asked them to hold it in abeyance, I would not need it.

Q. Where did you learn that there would not be any bids by any contractor?

A. I think it was here in the city.

Q. You mean through gossip, that there would be no bids?

A. What we term the "grapevine."

Q. What was the information that you had there would be no bid from any contractor?

A. That the call for bids was too general, not specific enough.

Q. And the result showed your information was correct, there was no bid received on it?

A. I understand there was no bid on it.

Q. And thereafter bids were called again for the 19th of October, [697] I believe the date was, and the work was segregated into driving the tunnel and seven other schedules of outside work, the finishing of the tunnel, the completion of the ventilating building, the installation of the mechanical and electrical and ventilating equipment in those buildings, and into various units of work. You knew that, didn't you, when you worked on your estimate?

A. Yes.

Q. You said that the grapevine told you that no bids would be received in the September, 1936 call

(Testimony of Lewis Michael Larson.)

because the call for bids was too general. Was there any difference in the call for bids in October except that the work was broken up into the eight schedules?

A. I think there was, just what the differences were I could not enumerate, but the contractors accepted it as more specific, and I think it is more specific.

Q. There was the same identical specification, was there not?

A. The general specifications I think was the same.

Q. And the tunnel specifications were the same?

A. I believe the chief difference laid in the fact that you paid the contractor in the second call for bids on so much per sack for grouting; I believe it was more specific as to what should be done in the way of finishing. That is as I recall it now.

Q. I think you are probably correct in that; in other words, what you are referring to now as being more specific was in the first call for bids it called for completing the project in that every portion of the tunnel had some work done upon it, and there was no portion of the tunnel that was completed?

A. I believe that was stated in the call for bids.

Q. That was true, was it not, when you made estimates on it?

(Testimony of Lewis Michael Larson.)

A. I was in no position to deny it. I assumed it to be correct.

Q. You went out and looked at the tunnel, didn't you, when you [698] were making the estimate?

A. Yes, but I did not study it in the same detail that an engineer would have studied it who was not in touch with all of the details.

Q. When you made this estimate prior to September 11, 1936, during the course of the preparation, did you go out to the site of the work and go over the tunnel?

A. You mean for the period after September 11—I am a little confused.

Q. I am only using the date of call for bids September 11, the date for which bids were called the first time, and the work was called for under one general contract to complete, I am asking you when you prepared this estimate that you said was never used if you went out to the job and went over it and observed the state of completion of the work?

A. I undoubtedly did; it is my custom always to do that.

Q. Do you have any independent recollection of whether or not you went on the job?

A. I know that I did but I cannot tell you the date nor the circumstances.

Q. It was before you completed the work on this estimate?

A. Correct.

(Testimony of Lewis Michael Larson.)

Q. When you visited the project did you observe whether or not the drift from the full excavated face had been driven in from the west portal, had been completed through to the east end of the tunnel?

A. My recollection is there was one drift that was not, and three that were.

Q. In other words, the most northerly drift in the north tunnel was not completely driven through?

A. It was not completely driven through.

Q. And in the same tunnel, the north tunnel, the wall plate drift had been completely driven through from the west excavated face to the east portal on the south side of the north tunnel?

A. Yes, it had been.

Q. That was on the south side of the north tunnel? A. Yes. [699]

Q. In the south tunnel the drifts had driven, the wall plate drifts had driven completely through the tunnel in to the east portal?

A. Yes, you could go from the west end of the tunnel through the drifts, in either drift to the east portal.

Q. So that at that time the ground to be encountered in each of the tunnels had been opened by a drift or drifts all the way through the mountain? A. Yes.

Q. All of the material in the mountain could be observed from those drifts and the nature of the ground?

(Testimony of Lewis Michael Larson.)

A. The material—I think it should be qualified—not all the material in the mountain, but the material.

Q. All the material in the mountain through which these drifts passed?

A. In that immediate vicinity of the drift, yes.

Q. You prepared two other bids in 1936. Let me withdraw that. You prepared two other estimates for bids on the completion in 1936. When was the first of the bids which you say were used by other contractors prepared by you?

A. Immediately prior to the offer of a bid for the completion of the tunnel. I don't remember the date.

Q. Well, for this purpose I think my memory is right. We will assume it was October 19th, I think that is the correct date. I am not sure, Mr. Larson, but I thought I understood you to say that the two bids that were used were prepared—the two estimates which you prepared were used on the second bidding; is that correct?

A. No, I did not intend it that way. The first estimate was the one used by the Six Companies of California, the first bid. The second estimate was not used by anyone. The third estimate was used by another contractor.

Q. Then you did not understand me when you made that statement. I was pointing to another period of time. I am only referring to [700] the

(Testimony of Lewis Michael Larson.)

estimate made by you after you left the Six Companies in December, 1935.

A. Yes. I made only two after that.

Q. You only prepared two estimates after you left, then, in December, 1935?

A. That is my recollection, yes.

Q. Is there any question about your recollection?

A. None at all.

Q. That is, apparently that you prepared two bids, one of them you never used, because you found no one to use it, and the second one was prepared after your first one, and was used by another contractor?

A. That is the case.

Q. Who was he?

A. George Pollock Company.

Q. George Pollock Company was the contractor who was the low bidder on the completion of the driving of the tunnel?

A. Correct.

Q. And the contractor who completed the work?

A. That is true.

Q. When was that bid prepared?

A. It was prepared immediately prior to the letting of the bid. I cannot recall the date when I began the estimate or when it was completed.

Q. How long did you spend preparing the estimate?

A. Ten days.

Q. At that time did you go out to the tunnel again?

A. I did.

Q. How many times did you visit the tunnel in the preparation of that bid?

A. Once.

(Testimony of Lewis Michael Larson.)

Q. Did you take any measurements of the work to be done?

A. Yes. I took a measurement in this respect: I took the distance stated in the call for bids. I took a rough check on the materials on the ground.

Q. Did you at that time complete an estimate in the same way that you prepared an estimate for Six Companies in 1934?

A. I did not transmit my papers to anyone to check extensions or to get me material quotations. I got those things myself.

Q. To whom did you deliver that bid?

A. To George Pollock, as I recall it; either to George Pollock or to his associate, Mr. Clifford. [701] I am not sure about that. I believe, though, it was Mr. Pollock.

Q. Where did you do the physical work of preparing this estimate during the ten days you worked on it?

A. In my apartment in this city.

Q. Did you keep any copy of that estimate?

A. I did.

Q. Have you a copy in your possession somewhere now?

A. I have a summary in my possession.

Q. Well, you also have a summary of the first bid that you prepared for the completion?

A. Yes, I have.

Q. Did you destroy your work sheet?

(Testimony of Lewis Michael Larson.)

A. Yes. I had no occasion to keep the work sheet.

Q. For your second estimate, which you prepared for Mr. Pollock, were you paid?

A. I was.

Q. Were you employed by him at the commencement of that, the preparation of that bid, or did you begin it as you had the previous one?

A. I commenced it as I had the previous one.

Q. And then you told them you were doing this work and offered your services in preparing the estimate?

A. I did not come that way. I had an offer from different contractors for my estimate, and I accepted the offer that Mr. Pollock had made to me.

Q. What was your reason for leaving Six Companies on April 30, 1935?

A. That would have to be answered by other people. I do not know.

Q. Were you discharged?

A. I ask again that you ask that information from other people.

Q. Well, I am asking you, Mr. Larson, whatever the reason was.

A. There was no reason stated, except that they wished to put the tunnel under one management, both tunnels under one management.

Q. And they told you your services were no longer required after that?

(Testimony of Lewis Michael Larson.)

A. They told me Mr. Whitmire would remain with them, continue with them, and that was, to me, an evidence that my services would not be required.

Q. Mr. Larson, when you were testifying the other day in regard to [702] your experience in tunnel construction in the Coast Range I believe you said that your first experience in the San Francisco Bay Region was in connection with the Bay Shore development of the Southern Pacific Company between 1905 and 1911; is that correct?

A. That is what I stated, yes.

Q. That involved the driving of the Bay Shore tunnels near the San Francisco Bay, from San Francisco down the Peninsula, the present line of the Southern Pacific Company.

A. Yes, one of those tunnels.

Q. One of those tunnels. Which tunnel was it that you had experience with?

A. The one known as Tunnel No. 4.

Q. How many tunnels are there in that development?

A. There are five on the operating line and one tunnel, No. 2, is duplicated; six tunnels in but only five used for operating purposes.

Q. Tunnel No. 5 was your tunnel?

A. No. 4.

Q. Tunnel No. 4? A. Yes.

Q. Which tunnel is that as you leave San Francisco?

(Testimony of Lewis Michael Larson.)

A. Tunnel No. 4 is just as you enter what is known as the Bay Shore Yard.

The Court: The first tunnel, the second tunnel, the third tunnel, or which?

A. It is the fourth tunnel from San Francisco.

Mr. Tinning: Q. The fourth tunnel from San Francisco?

A. Yes, the fourth tunnel from San Francisco.

Q. How long a tunnel is that?

A. My recollection is that it is about 4500 feet.

Q. Through what kind of material is it driven?

A. Through some serpentine and, I think, shale. That is merely my definition, I am not a geologist and I wouldn't say the definition is correct.

Q. Well, serpentine and shale formed the majority of the material [703] through which the tunnel was driven? A. As I recall it.

Q. Is that self-supporting material?

A. No, it is not.

Q. Did you have to timber that tunnel as it was driven? A. I did for portions of it.

Q. Was it driven by the full face operation?

A. No, it was not.

Q. Were there any drills, jumbos, or drifters used in that tunnel?

A. No. In those days we did not have anything but what they termed "double jacking," "single jacking," that is, hand work.

Q. In what capacity were you employed on that work? A. I was the general foreman.

(Testimony of Lewis Michael Larson.)

Q. Who was your superintendent?

A. Mr. Dow.

Q. Was that the first tunnel work that you ever did in the San Francisco Bay Region?

A. It was.

Q. You stated you were employed on that work, the Bay Shore work, from 1905 to 1911?

A. I was.

Q. I think you also stated you were not on the tunnel all of that time, you were in some yard as general foreman.

A. When the tunnel was completed.

Q. How long did it take to drive that 4500-foot tunnel?

A. I think about a year and a half with the driving from both ends. I am not sure of that, I have not any data on it.

Q. How big was the section, what were the dimensions, width and height?

A. I think 26 feet 5 inches high at the center, and about 27 feet wide. I am speaking of the concreted section. That is as I recall it.

Q. How thick was the concrete?

A. Approximately 3 feet. The concrete was an arch lined, brick arch, or a spring line.

Q. Then the walls were practically perpendicular, were they?

A. They were perpendicular.

Q. They were perpendicular?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. They ran up about how high?

A. I think it was 10 feet 6 inches.

Q. The rest of the arch, you stated, was brick?

A. The total of the arch was masonry work.

Q. You stated something about total.

A. The total arch.

Q. The total arch.

A. We speak of the spring line up to a certain point.

Q. That was a perpendicular concrete wall and then the circular portion with the arch laid in the brick?

A. Yes.

Q. Was the core removed before the arch was placed?

A. No. [705]

Q. In other words, you studded in the core of that tunnel as it was drilled?

A. That is true. I might tell you more of it, to make it a little clearer, if I am permitted.

Q. Yes.

A. We had this earthquake, that we might have celebrated yesterday, during the period of that work; and after the earthquake, it seemed very heavy pressure came on the tunnel. It had been registered during the period when we were shut down; and immediately following the earthquake, the minute we began to work the ground, the timbers began to take terrific pressure, and we had to have the core to give support on that account; otherwise, it might have stood without support.

(Testimony of Lewis Michael Larson.)

Q. Well, there was a considerable period, then, after you got some of your excavating done, your timbers in, when you were delayed in construction due to the interruption of the earthquake, and pressure came on those timbers during that period?

A. I think the result of the shake caused it, and may have been immediate but it did not register until we began to move the timbers.

Q. How long was it after the earthquake before you resumed work in the tunnel?

A. My recollection was about 10 days.

Q. It was not a very long period? A. No.

Q. When was the heavy pressure, that you referred to, registered; how long after?

A. Immediately after we resumed.

Q. In 10 days?

A. Yes. We began taking the timber supports out that were resting on the core, in order to lay in the brick and masonry. As soon as that operation began, they began to show signs of weight.

Q. How long, or how far, had the tunnel been driven when the earthquake came over the horizon?

A. I think the lower drift—we used the drift system—I think the lower drift was in about six or eight hundred feet; that is my recollection; and the core had been [706] removed possibly three or four hundred feet.

Q. When the core was removed in this Bayshore Tunnel No. 4, was the brick arch in at the time you removed the core? A. Yes.

Q. In other words, you put your permanent lining in before you removed the core? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. Prior to the earthquake, when you were removing the timber, putting in your masonry arch, brick arch, up to that time, you supported the arch by stulls against the core? A. We did; yes.

Q. You did the same thing after the earthquake?

A. Yes.

Q. So, the only result of the earthquake, in so far as the driving of that tunnel was concerned, is that for a time you had heavy pressures following the earthquake? A. That is true.

Q. More difficulty than you had before?

A. Yes.

Q. But the method used in driving the tunnel was the same? A. It was the same.

Q. You took out the timbers, and you carried your masonry arch around before the timbers were taken out? A. Yes.

Q. You had to stull against this timbered arch, as you put it in? A. We did do so.

Q. Did you take all the timbers out of that Bay-shore Tunnel?

A. I think we did. I am not entirely clear on that.

Q. That was not self-supporting ground; but you took all the timbers out?

A. That was possible to do that, by the method we pursued, yes.

Q. And you did?

A. Yes. Let me clarify that: To my recollection, we did.

Q. You were there, Mr. Larson?

(Testimony of Lewis Michael Larson.)

A. Yes, I was there.

Q. You are giving us your best recollection?

A. Yes.

Q. Now, apparently after you left the Southern Pacific Company in 1911, at the conclusion of your work on the Bayshore Cut, you were [707] not engaged in the vicinity of San Francisco for five or six years; your work was in other places?

A. That is true.

Q. And apparently, out of California?

A. Yes, out of the State.

Q. You then returned to San Francisco in 1918, and you were employed by the Foundation Company of New York near Colma?

A. At Tacoma; Tacoma, Washington.

Q. Oh, Tacoma, Washington? A. Yes.

Q. My notes are not very clear on that. Then you were not around San Francisco in 1918?

A. No; I was not.

Q. The next time, according to my notes, you were back in San Francisco, or in the vicinity of San Francisco, was in 1923, when you had some work for the Spring Valley Water Company, in the vicinity of Niles Canyon? A. In Niles, yes.

Q. That continued from 1911 to 1923, a period of 12 years, which meant that you were not around San Francisco? A. That is correct.

Q. That is, engaged in tunnel work?

A. Engaging in tunnel work, is correct.

(Testimony of Lewis Michael Larson.)

Q. During that period from 1911 to 1923, did you keep in touch with the general development of tunnel construction in the San Francisco Bay region?

A. I did. This is my home, and consequently, I was interested in whatever might be doing.

Q. I suppose you read the engineering literature that comes out,—the various journals—for instance, the Western Construction News and others that I might call professional journals that have to do with construction work in this vicinity?

A. I do, when they are available, when I have the opportunity.

Q. Well, were you in touch with any of, or did you know about, the construction of other tunnels in that period between 1911 and 1923?

A. I visited the Twin Peaks Tunnel during the period of the opening of that work. [708]

Q. What year was that?

A. That was 1915.

Q. Did you make any observations of the driving of the Stockton Street Tunnel in San Francisco, which commenced, as I recall, in 1913?

A. No; I did not. I was then up in Oregon.

Q. Did you make any observations of the driving of the Fort Mason Tunnel in 1914?

A. No. I was out of the state at that time.

Q. Did you know about that? A. I did.

(Testimony of Lewis Michael Larson.)

Q. Did you make any observations of the driving of the Richmond Vehicular Tunnel?

A. I did not.

Q. Did you know anything about that?

A. No; I know nothing of that.

Q. Now, you started in 1923 with the Spring Valley Water Company; and what were you doing for that company?

A. I was superintendent for them, putting that aqueduct from Niles Canyon, just before the San Francisco Water Department acquired the Spring Valley Water Company.

Q. Did the aqueduct you refer to require any tunnel work? A. No.

Q. Just open cuts?

A. That was all open cut.

Q. And covered? A. Yes.

Q. That work was between Niles and what point? A. Sunol; between Niles and Sunol.

Q. It was the aqueduct that connected the water gate at Sunol with the lines of the San Francisco?

A. It was the replacement of the wooden aqueduct, that was there, by a concrete aqueduct.

Q. In other words, in your work there, did you observe the tunnels in Niles Canyon?

A. I did.

Q. Are any of those tunnels in self-sustaining ground?

A. My judgment is that they are not.

(Testimony of Lewis Michael Larson.)

Q. Did you observe whether or not they were timbered?

A. They are timbered; or were timbered, at that time. [709]

Q. In your judgment, they were not built on self-sustaining ground?

A. I assume that from the fact they were timbered.

Q. Then, as I understand it, your tunnel operations were resumed with the construction by Twohy Brothers of the Hollywood Tunnel in Los Angeles?

A. Yes.

Q. You were there for about two years?

A. Yes.

Q. Some time in 1925 was that work done?

A. I think it was in 1924 and '25.

Q. How long a tunnel is the Hollywood tunnel?

A. I think it is 4325 feet.

Q. What were the dimensions of the tunnel,—the width overall, or inside, the finished lining, and the height?

A. Inside, the finished lining, it is 25 feet between walls; and I think about 23 feet high at the center.

Q. Was it lined? A. It was.

Q. With what material? A. Concrete.

Q. Were the timbers removed?

A. They were.

(Testimony of Lewis Michael Larson.)

Q. Was that tunnel driven by a full face driving operation? A. It was not.

Q. Was it driven in self-supporting ground?

A. It was not.

Q. It was driven by a drift method, was it not?

A. Yes.

Q. There were considerable difficulties encountered in driving?

A. We did have difficulties, yes.

Q. Against pressures? A. Yes.

Q. Use breast boarding in places?

A. I don't recall we used any breast boarding.

Q. Did you drive any spiling?

A. No; we did not drive spiling.

Q. Did you advance spiling by taps of sledge hammers? A. Yes.

Q. When did you finish that Hollywood Tunnel?

A. My recollection is it was in July, 1925. That is only a guess. [710]

Q. Following that, you prepared an estimate for a tunnel in the vicinity of San Francisco, did you not? A. Yes.

Q. What tunnel was that?

A. Then known as the Duboce Tunnel; I think now known as the Sunset Tunnel.

Q. Is the ground in the Duboce Tunnel self-supporting? A. Some of it.

Q. You found that out afterwards?

A. Yes, afterwards.

(Testimony of Lewis Michael Larson.)

Q. In preparing your bid, did you assume that the ground would be self-supporting?

A. My memory is not clear on that.

Q. What was the size,—the dimensions,—of the Sunset Tunnel?

A. I think it was about the same size and dimensions as the Hollywood Tunnel.

Q. About 25 feet in width, and about how high?

A. About 22 or 23 feet high, I think.

Q. Was the Sunset Tunnel lined throughout?

A. I believe it was.

Q. Do you know whether the timbers were removed?

A. Yes. In fact, I know some of them were not.

Q. Following your work with Twohy Brothers, in preparing an estimate on the Sunset Tunnel, you prepared an estimate for Twohy Brothers on the Claremont Tunnel, did you not? A. I did.

Q. Then you were later employed as a superintendent of construction on the Claremont Tunnel?

A. I was.

Q. How long was your occupation there at the Claremont Tunnel?

A. I believe it was about June, 1926 until November or December, 1929.

Q. In other words, slightly over three years?

A. Yes.

Q. That tunnel was what size?

A. The excavated size was 12 by 12. The line between was 9 foot horseshoe.

(Testimony of Lewis Michael Larson.)

Q. There was an invert at the bottom.

A. Yes.

Q. And a concrete pipeline of about 9 feet, approximately? A. It was 9 feet. [711]

Q. Was it completely round?

A. No. It was a horseshoe.

Q. How wide was it? A. 9 feet.

Q. How high? A. 9 feet.

Q. So you had an invert at the bottom and a horseshoe at the top? A. That is true.

Q. The excavation of that tunnel was 12 by 12? A. Yes.

Q. How long was the tunnel?

A. 18,004 feet.

Q. It was a water tunnel which was constructed by Greer and Meade, your employers, under a contract with the Eastbay Municipal Utility District, as a part of its system leading from Pardee Dam, into the City of Oakland? A. Yes.

Q. Leading through the Coast Range?

A. Yes.

Q. Leading through the same hills, same mountains, as the Low Level Broadway Tunnel was?

A. Yes.

Q. Following this, you prepared a bid on the Figueroa Tunnels in Los Angeles? A. Yes.

Q. What was the size of those tunnels?

A. My recollection is they are about 46; between 46 and 50 feet wide, inside the lined sections, and somewhere about 30 feet high at the arch.

(Testimony of Lewis Michael Larson.)

Q. How long were those tunnels, approximately?

A. I think they would average about 400 feet; some were longer, and some were shorter.

Q. In preparing your estimate, did you have a knowledge of the materials through which the tunnels were driven?

A. I had such knowledge as I gained from my own observation.

Q. Did you conclude, before you completed your estimate, the materials through which those tunnels were driven were self-supporting?

A. No; I did not, on account of the size of them.

Q. On account of the size of them?

A. Yes.

Q. In other words, the materials through which they were driven were not self-supporting for tunnels of the size that were built [712] to those specifications—It was true that steel support was used to hold up the material while the lining was being put in?

A. That was the design of the——

Q. That was done, was it not?

A. That was, yes.

Q. Following your estimate on those tunnels, you prepared an estimate for a sewer tunnel in San Francisco. For whom was that estimate?

A. Mr. Meade,—W. S. Meade.

Q. The same man you worked for on the Claremont Tunnel?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. What was the name of the tunnel?

A. I don't recall the name—It is out here in the vicinity of the Bernal Cut.

Q. How long was it?

A. Oh, I think about three-quarters—between half and three-quarters of a mile.

Q. What was the size of it?

A. I think about 6 feet on the inside. That is rather a faint memory.

Q. Was the material through which this tunnel was to be driven, in your opinion self-supporting?

A. We had information that on this end we would run into water and sand; there were some borings that gave us that information. The other portion of the tunnel—my recollection is not clear as to what the formation might be,—the conclusion I arrived at.

Q. You don't recall now whether you concluded there was any part of this tunnel that was to be built, that you assumed was to be built, through self-supporting material?

A. I don't recall that now; not clearly enough to testify to it.

Q. You then prepared an estimate a little bit out of the San Francisco Bay region, but in Northern California,—the Newcastle Tunnel,—which is a portion of the road from Sacramento to Reno?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. Was that tunnel built in self-supporting material?

A. I thought it would be when I estimated it, excepting at the two portals. [713]

Q. What was it, actually?

A. The information I have is after the tunnel—the drift penetrated the tunnel a certain distance, and they found very hard granite.

Q. Quite a different material than anything found here in the San Francisco Bay region?

A. The formation there is different.

Q. That is the Sierra—the foothills of the Sierras? A. Yes.

Q. And a few miles east of Rocklin, where the granite, the ripraps for the Southern Pacific Line, is taken?

A. Yes; they are on this side.

Q. In other words, it is in the granite area?

A. Yes.

Q. They wouldn't be found around here?

A. Not to my knowledge.

The Court: We will take a recess until two o'clock.

(Thereupon, an adjournment was taken until two o'clock, p. m., this date.) [714]

(Testimony of Lewis Michael Larson.)

Afternoon Session

Two O'clock

LEWIS MICHAEL LARSON,

Cross Examination (Resumed)

Mr. Tinning: Q. Mr. Larson, following completion of your estimate for Mr. Meade on the Newcastle Tunnel I understand that you prepared an estimate for a bid on the Wawona Tunnel, which I understand is a tunnel on the southerly road leading out of Yosemite Valley?

A. That it right.

The Court: Is that one the granite tunnel?

A. Yes.

Mr. Tinning: That was a tunnel in which the material was self-supporting, was it not?

A. Yes, I think it was with very little exception.

Q. You so considered it in preparing your estimate for a bid?

A. I did, except that portion in which there was a valley that ran down close to the roof of the tunnel, where I thought some support might be needed.

Q. During construction?

A. During construction, yes.

Q. That is in the granite of the Sierras?

A. Yes.

Q. Following that you made an estimate for a bid for a C. P. R. tunnel in Vancouver?

A. Yes.

Q. What was the tunnel?

(Testimony of Lewis Michael Larson.)

A. It was a railroad tunnel that connected two yards of the C. P. R.

Q. Do you know the name of it?

A. I don't know the name of it.

Q. How long was it, approximately?

A. I think about three-quarters of a mile.

Q. What size?

A. It was a single track tunnel which made it about 17 feet in width on the ground and about 20 feet high.

Q. Was that tunnel lined with concrete lining?

A. It was contemplated to be lined, and I think it was.

Q. What kind of material was that tunnel driven through? [715]

A. I have not any definite knowledge of it, except the survey I personally made of other tunnels in that vicinity.

Q. What did you find from your survey?

A. Laminated material where the laminations were lying in horizontal layers instead of vertical layers, or nearly vertical.

Q. In preparing your estimate for that bid did you assume that the tunnel would require timber supports during its construction?

A. I have forgotten now whether we would have followed directly with lining. I know we had to put in some rails in the concrete. If the rails were considered as support during the construction of course I would not figure on any timber, and I do

(Testimony of Lewis Michael Larson.)

not definitely remember, but I believe when I figured I figured it was a tunnel to be supported by timbers. That is my recollection now.

Q. Following your work in connection with the tunnel at Vancouver, you prepared an estimate for Lindgren & Swinerton for a tunnel at Boulder Dam? A. Yes.

Q. In preparing this estimate for the cost of construction of those tunnels did you assume that the ground would require support during construction? A. 10 per cent of it.

Q. 10 per cent of it? A. Yes.

Q. Did you plan in that tunnel to operate on a full face driving method? A. I did.

Q. And those tunnels were constructed through material which required little or no timber support? A. That is my understanding.

Q. You never saw them during the construction? A. I did not.

Q. Where were the tunnels which you worked on for Merritt, Chapman and Scott near Ventura?

A. Between Ventura and Maricopa.

Q. On what route were they?

A. On the route known as the Ventura-Maricopa Highway, which would be a connecting line [716] between, as I understand it, the Valley Route and the Coast Route.

Q. Between the Coast Route and the Valley Route? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. What was the length of those tunnels?

A. I think the three of them totaled under 1500 feet. I have forgotten the definite length.

Q. What was the size of the tunnels, the dimensions?

A. Standard highway tunnel, which would be approximately 30 feet in width and about 25 or 26 feet in height.

Q. Were those tunnels lined with a concrete lining?

A. Only the portal section, and one part of the tunnel known as Tunnel No. 2, that was in a broken formation, that was lined during the period I was there, and then I am told that they lined all three tunnels completely.

Q. Was each tunnel timbered during construction?

A. No, that is, two of them were not, one was.

Q. Will you give us from the west toward the east the portions of the tunnels that you refer to? You said a portion of the tunnels were lined immediately following the construction.

A. Tunnel No. 1, that is the one nearest to Ventura, near the portal section of the tunnel, my recollection is about 10 feet, from 5 to 10 feet of the tunnel; Tunnel No. 2, the next one, about 30 per cent of the tunnel from the west end, and the two portals, with the eastern portal having about five feet of lining. Tunnel No. 3, there were two por-

(Testimony of Lewis Michael Larson.)

tals, the one farthest from Ventura there was approximately 50 feet of the lining near the portal and the east end of the tunnel.

Q. Was timber placed in any portion of the tunnel where there was no concrete lining?

A. No.

Q. What type of material were these tunnels driven through?

A. The first tunnel, No. 1, I don't know the name of the rock, but it was so near to a rock that would not stand as it was possible to without collapse, it was pretty well broken material, and Tunnel No. 2, after we passed through the laminated section for about 35 or 40 per cent of the distance, I think it was 30 per cent, we ran into what was termed an agglomerate, which I have been told is different from a conglomerate in that there is a clay cementing material instead of a sand cementing material. In the third tunnel the rock was considerably firmer. Whether it was granite or not I am not prepared to say.

Q. I think I understood you to say that the third tunnel was where you had lining.

A. The second tunnel.

Q. How far from Ventura is the most westerly of these tunnels, approximately?

A. Between 15 and 20 miles, probably 20 miles.

Q. How far is it from the most westerly tunnel to the most easterly tunnel?

(Testimony of Lewis Michael Larson.)

A. A distance of one additional mile, approximately.

Q. All three tunnels were within a space of a mile on the highway? A. Yes.

Q. Following your work for Merritt, Chapman & Scott near Ventura you prepared an estimate for Lindgren & Swinerton to bid on the outlet tunnel for the San Gabriel Dam No. 1?

A. Yes.

Q. What was the size of that tunnel?

A. That was 30 feet inside the lined section.

Q. Was that a water tunnel with an invert in it?

A. Yes, it was a circular tunnel completely lined.

Q. Was timber used in the construction of the tunnel, do you know?

A. Not a great amount of it.

Q. What type of material was it driven through?

A. It was a rock similar to the one that I represented as being in the No. 1 tunnel of the Maricopa tunnels where it was a question of whether it should have been timbered or whether it was dangerous without timber. [718]

Q. Following this work on the San Gabriel Tunnel you prepared an estimate for Lindgren & Swinerton for work on the Hetch Hetchy Tunnel?

A. Yes.

Q. And the portion of the Hetch Hetchy tunnels which you testified were those lying east of Niles and south of Livermore, through the Coast Range, were they not? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. How many miles of that tunnel did you consider in your estimate, approximately?

A. I have forgotten the miles, but there is a man here that could answer it.

Q. I just want an approximation.

A. I think approximately in the vicinity of 6 miles.

Q. What was the size of that tunnel?

A. 15 feet, between 15 feet excavations, as I recall it.

Q. In preparing your estimate did you assume that you would require timber?

A. Through the major portion of it, yes, it would definitely require timber.

Q. That tunnel was lined with concrete lining?

A. It was.

Q. With an invert?

A. Yes, that was also a circular tunnel.

Q. At the time that you prepared your estimate of the Broadway Low Level Tunnel for the Six Companies in 1934, were you acquainted with the troubles and difficulties that had been encountered in the Hetch Hetchy tunnels? A. I was.

Q. You knew at that time, Mr. Larson, that due to the difficulties there encountered the contractor had been required to keep his concrete up close to the face of his excavation?

A. I knew that he had concluded it was necessary.

(Testimony of Lewis Michael Larson.)

Q. Following your estimate on the Hetch Hetchy tunnels you prepared an estimate for the Yerba Buena tunnel on Goat Island on part of the San Francisco Bay Bridge? A. I did.

Q. In preparing that estimate what did you assume with respect [719] to the ground you would encounter?

A. I thought we would have to do a little timbering there, but the plan of progress had something to do with the answer there, the plan being to drive the two side walls and then concrete that—the plan and specifications also called for steel beams to be placed—

Q. Steel beams?

A. Steel beams. I contemplated placing them as I took out the ring and work from those for a support for my concreting.

Q. In other words, in the method that you adopted in preparing your estimate you were going to leave the core in until after the permanent lining was installed in the tunnel? A. I was.

Q. What was the size of the tunnel?

A. I think it was 58 feet in width—that is my recollection of it.

Q. How high?

A. I should judge, my recollection is it was about 40 feet high; that is only approximate.

Q. Was this ground through which the tunnel was constructed self-supporting?

A. In certain localities I understand that it was.

(Testimony of Lewis Michael Larson.)

Q. When you prepared your estimate what did you consider you would encounter?

A. I thought we might find some broken ground in the side walls, pouring concrete in the side walls, and giving me the use of the steel beams for the arch would not necessitate the use of very much timber; furthermore, the grouting was to be done on the arch so as to make the ground from the arch practically self-supporting on filling in voids and bonding together the rock that might be disassociated.

Q. That was something that would be done during the construction and when the job was done you would have a solid grouting?

A. My recollection is that the grouting would be done in advance of excavation.

Q. In preparing your estimate did you assume that steel would be [720] placed by the owner or furnished by the owner for that tunnel?

A. No, I do not recall that it was; it was a bid item, that is my recollection now.

Q. As a matter of fact, in the construction of that tunnel steel beams were used from portal to portal, were they not?

A. That is my recollection.

Q. And after they were installed the concrete lining was placed in the tunnel in the space between the ring and the core was excavated?

A. Yes.

Q. You did not consider that ground self-sustaining, did you?

(Testimony of Lewis Michael Larson.)

A. The way it was to be handled, yes, I would. In the first place there was grouting to be done to bond the material at the arch; the side walls I did not consider as self-sustaining; it was only in part that would be true.

Q. So your answer then would be that you considered the ground at the Yerba Buena tunnel partly self-sustaining and partly not self-sustaining?

A. That is true.

Q. If the ground was self-sustaining why were steel beams installed throughout the tunnel?

A. I think that is a question that a designing engineer only could answer; what the purpose was I could not say.

Mr. Tinning: If your Honor please, we would like to offer in evidence on behalf of the defendant a diagram, map showing the location of a number of tunnels, and I think all of the tunnels we thought of in the vicinity of San Francisco Bay. It is a diagram taken from a Government map, a photograph of a Government map, upon which we have indicated the location with approximate accuracy for the purpose of being used in connection with the testimony of this witness, and the table on the left shows the numbers which have been given to the different tunnels simply for the purpose of identification. We offer it as Defendant's Exhibit B. [721]

(The map was marked "Defendant's Exhibit B.")
[Set forth in the Book of Exhibits at page 323.]

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Q. Mr. Larson, I will ask you to look at this diagram and I will point out to you various tunnels which are in existence at the present time, and I attempt to call your attention to various tunnels which were in existence at the time that you prepared your estimate. We have just been talking about the Yerba Buena Tunnel, which is shown on the diagram, Defendant's Exhibit B, as No. 15. On the portion of the map marked San Francisco, with the number 24, is indicated the most northerly tunnel on the bay shore. Are you familiar with that tunnel? A. In a large measure, yes.

Q. How long is it, approximately?

A. Approximately 2,000 feet.

Q. About 2,000 feet? A. Yes.

Q. What type of material was that tunnel constructed through?

A. That was a broken formation.

Q. Was the tunnel which is marked here as No. 24, and I assume from what you said that would be Tunnel No. 1 on the Bay Shore? A. Yes.

Q. Was that tunnel timbered during construction? A. It was.

Q. Was the timber removed in the same way that you have described in No. 4 tunnel this morning?

A. I believe all of it was, though my contact with it is not definite enough to say all, I think it was.

(Testimony of Lewis Michael Larson.)

Q. You were generally familiar with it during construction? A. Yes.

Q. As you were working on the same project?

A. Yes.

Q. Was that tunnel driven by a full face method?

A. It was not.

Q. Was it driven in the same way that Tunnel No. 4 was driven?

A. Very much the same way.

Q. The wall construction? A. Yes.

Q. The ring advanced ahead of the excavation and the masonry and [722] brick wall?

A. Yes.

Q. No. 23 is the subway for the Ferry Building. That I do not think is comparable. A. No.

Q. No. 16 shown on this map is the Stockton street tunnel. A. Yes.

Q. Now, were you familiar with the construction of that tunnel? A. Only from hearsay.

Q. Have you a knowledge of the general conditions from your general knowledge of tunneling in this area as to whether it was in self-supporting ground? A. I believe it was not.

Q. It was built by the ring method stalling against the core?

A. A good portion of it was.

Q. Wasn't all of it?

A. I understand that they started in without doing so and got into trouble.

(Testimony of Lewis Michael Larson.)

Q. And that then they studded against the core and put in the concrete lining?

A. I believe that is true.

Q. And thereafter removed the core?

A. That is my understanding.

Q. And the lining of that tunnel is some two and a half feet at the top and some eight and a half feet at the base?

A. That I don't know.

Q. Would you say that the Stockton street tunnel was built in Self-supporting ground?

A. I would think not, because of the improvements alongside; that has something to do with it; you do not take any risk when you have apartment houses right alongside.

Q. Is the risk a different thing than where the ground is self-supporting?

A. Yes, you have to couple the two facts together; you will take a chance on self-supporting ground with no improvements that you would not take if there are any improvements that are likely to be damaged by your oversight, if there is one.

Q. So that you are not able to say whether or not the ground under the Stockton street tunnel through which the Stockton street tunnel [723] was driven was self-supporting ground?

A. I am not in a position to say.

Q. Even though it was driven with a temporary

(Testimony of Lewis Michael Larson.)

lining stulted against the core and the concrete lining installed before the core was removed?

A. No, because I knew the conditions that preceded it, that had an influence on it.

Q. What were the conditions that preceded it?

A. The contractor who began it had, as I understand, little experience in tunnel work, and allowed the concrete to get beyond control, and that caused what we term a fear complex to the contractor and to the City, and a different method was then adopted, that assured against any accident or unwarranted hazard.

Q. What was the method that the contractor adopted that proved unsuccessful and installed the fear in the city?

A. My understanding is that they started in much like they would in an open cut with an open face method in the beginning, without developing the ground to see whether it had self-supporting features.

Q. In other words, instead of driving drifts into the ground which is to be excavated and exploring it ahead of the excavation, they undertook a full face operation and got in trouble?

A. That is the information that has come to me.

Q. Will you please look at No. 18, shown on this diagram, Defendant's Exhibit "B", which is intended to represent the Twin Peaks Tunnel? I understood you visited that.

A. Just as they were going underground. [724]

(Testimony of Lewis Michael Larson.)

Q. You also testified, I believe, that the materials encountered in the Twin Peaks Tunnel were not self-sustaining?

A. I could not say anything about that, because I saw it only at the beginning of the work.

Q. From your general knowledge of the conditions in the Bay region, founded upon the excavations of various tunnels, would you assume the ground encountered in the Twin Peaks Tunnel was self-sustaining?

A. I would have to answer that by enlarging upon the conditions there. You have a double-track tunnel that is unusually wide.

Q. How wide, approximately?

A. I am not informed on that; but there was a curtain wall, I think, in the center, to make provisions for pedestrians to go down, at different points in the tunnel, to enter the cars; and I believe that it is separated; that curtain wall may have been a sort of safeguard against passengers attempting to go over onto the other side. This is conjectural.

Q. What would that have to do with the method used in construction?

A. It would have a tendency to separate out the width of your tunnel, and leave a flatter arch; a flatter arch would be more difficult to hold than one that had an even circle all the way around.

Q. The design that is used in that tunnel, you

(Testimony of Lewis Michael Larson.)

could assume it had some control over the methods that were necessary in driving?

A. That, and the price of lumber. The price of lumber, I think, was \$8.50 a thousand.

Q. Was there a great deal of timber used in the Twin Peaks Tunnel?

A. I could not say; I really don't know.

Q. Then, how would the price affect the driving?

A. Well, it is just inference that, if you could give either timber or concrete support to it, and your material price of lumber is very cheap, the tendency to put in lumber is increased by the price of the material to be erected; and where you might feel you could take a chance on [725] that untimbered tunnel, if the timber is cheap you will put it in.

Q. But you don't know what they actually encountered there, and you did not inquire, in connection with your preparation of the bid, or other bids for tunnels in this Bay area? A. I did not.

Q. Coming over to the tunnel which is marked "17" on the diagram,—the Sunset or Duboce Tunnel,—on which you prepared an estimate: I think you testified, this morning, that you thought part of the material through which that tunnel was driven was self-supporting, and part was not?

A. That is the understanding I have.

Q. Did you see that tunnel at any time during construction? A. I did.

Q. At what stage did you see it?

(Testimony of Lewis Michael Larson.)

A. I visited it from the east end,—that is, from this end of the tunnel; and the excavation then had advanced, as I recall it, about 1,000 feet from the east portal. The concreting operation was just beginning. Because of some heavy ground that was encountered at that point, the preparations for concreting, I believe, had just been completed, and they were about to pour.

Q. Was the portion of the tunnel, which you saw, timbered throughout? A. It was.

Q. Did you ever see the tunnel after that?

A. I did not; not until after it was completed.

Q. Did you see the tunnel again after that?

A. I have seen it since it was completed.

Q. As a matter of fact, that tunnel was timbered throughout, was it not?

A. I understand that there were portions there, at least in the drifts, where no timber was required; but, later on, it was fully timbered.

Q. How was that tunnel driven; was it driven by open face?

A. Driving two wall plate drifts, and a top drift, and then the connecting part, which we term "the ring," was done in it; and then [726] the core removed,—I think, in much the same manner as the wall plate drift that I had planned for the first 720 feet of the Broadway Tunnel.

Q. It is a fact, is it not, that the timbering in that tunnel settled during construction, and it was

(Testimony of Lewis Michael Larson.)

constructed some 8 or 10 inches below the original designed grade?

A. That is my understanding.

Q. And there were many difficulties involved in the construction of that tunnel?

A. On this end,—the east end, I believe; yes.

Q. That tunnel, you stated this morning, you considered was on partly self-supporting ground and partly in non-self-supporting ground?

A. From the report that I had on the tunnel, that was my conclusion.

Q. And the difficulties that were encountered in that tunnel,—the fact that a thousand feet of tunnel had been left open, the timber had settled,—so the tunnel had to be built on a different alignment from the original design—you had all those facts in mind at the time you prepared your estimate on the Broadway Low Level Tunnel?

A. I knew, in a general way.

Q. Well, you knew, then, what you are stating now, did you not?

A. Not all; no. Since then, I have made inquiry more in detail.

Q. Tunnel No. 19 is a tunnel under Fort Mason. I think, this morning, you stated that you did not recall having any particular knowledge regarding that tunnel?

A. I have very little knowledge of that.

Q. Do you know that that tunnel was built in 1913, prior to the construction of the 1915 Exposit-

(Testimony of Lewis Michael Larson.)

tion, and freight was carried through that tunnel?

A. That was the information I had.

Q. And that a large portion of those tunnels was built through sand and clays and soft rocks?

A. I did not have the details on it. [727]

Q. And that there were difficulties with slides?

A. No; I had not information on that,—on that angle.

Q. Mr. Larson, if you cannot see what I am attempting to point out here, will you tell me?

A. Yes, I think I can see from this point.

Q. Now, going north from San Francisco, we come to two tunnels on the Marin County shore: one is the Waldo Tunnel,—which, of course, was not constructed; that was No. 21 on the diagram, and that was not constructed at the time you prepared your bid for the Broadway Low Level Tunnel? A. It was not.

Q. Did you know about that Tunnel No. 20,—the Fort Barry Tunnel,—that is located on Government reservation?

A. Not until after my association on the Broadway Tunnel.

Q. Do you know, now, whether that is built on self-sustaining material?

A. Some of it was, yes.

Q. That is a timbered tunnel, is it not?

A. I think they recently lined it with concrete.

Q. Up to three or four years ago, and for a number of years, that tunnel was a timbered tunnel?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. A narrow, vehicular tunnel? A. Yes.

Q. About the size of the old tunnel that you observed when you were inspecting this Broadway Low Level Tunnel site?

A. Very similar in size.

Q. And was supported by timbers approximately the same size, was it not?

A. Yes, excepting at the portal.

Q. How were they supported?

A. Concrete lining.

Q. There were concrete rings in either portal in the heavy ground?

A. That is my information.

Q. So, you knew about that at the time you prepared your estimate for the Broadway Low Level Tunnel?

A. No; I knew nothing about [728] this.

Q. You learned about that after. Did you have any knowledge of the tunnel between Tiburon and San Rafael?

A. No; I did not.

Q. Do you know anything about it now?

A. No; I do not.

Q. You haven't paid any attention to it?

A. It is a railroad tunnel.

Q. Yes. Coming across the Bay to Contra Costa County, I will ask you if you know anything about, or knew anything about, the Santa Fe Tunnel, on the road leading from the Richmond Station down to the old ferry wharf which ran through the Potrero Hills,—the range that lies between the Bay and the City of Richmond.

(Testimony of Lewis Michael Larson.)

A. I knew nothing about it.

Q. Have you ever familiarized yourself, since you made an estimate on the Broadway Low Level Tunnel, with the conditions there?

A. Not in this tunnel you are referring to.

Q. Immediately south of the Santa Fe Tunnel that I have referred to, is the tunnel which we have designated here as Tunnel 14,—the Richmond Tunnel,—vehicular tunnel,—which carries automobiles and other vehicles through the same range of hills that the Santa Fe Tunnel takes the trains through. Were you familiar with that tunnel at the time you prepared your estimate for the Broadway Low Level Tunnel?

A. I was not.

Q. Are you familiar with it now?

A. No; I cannot say I am; I have paid no attention to it.

Q. You have no knowledge with respect to it?

A. I knew there was a tunnel there; but I knew nothing about the size.

Q. Knew nothing about the method with which it was constructed?

A. I knew nothing about the methods or the formation of the material.

Q. Proceeding farther towards the east, we find a tunnel which is [729] marked "Tunnel No. 2,"—The San Pablo Water Tunnel, constructed by the Eastbay Water Company, to carry the water from the San Pablo Dam through the hills into North Berkeley. You are familiar with that tunnel, and

(Testimony of Lewis Michael Larson.)

you were when you made your estimate for the Broadway Low Level Tunnel?

A. Only what I had explained to me at the time when I went in the Claremont Tunnel.

Q. When you were in the Claremont Tunnel?

A. Yes.

Q. At the time when you were in the Claremont Tunnel, did you learn that there had been a great many difficulties encountered in construction of the San Pablo Tunnel?

A. I heard there were some; I did not know how many.

The Court: What year was that?

Mr. Tinning: The tunnel was constructed, if I remember correctly, about 1915.

Q. That tunnel is something over two miles long, is it not? A. I don't know.

Mr. Wittschen: 1918 is the correct year.

Mr. Tinning: 1918, it was constructed.

The Witness: I don't know the length of it.

Mr. Tinning: Q. You heard there had been many difficulties encountered in that tunnel, and timbering was required throughout,—heavy timbering?

A. I heard there were portions of the tunnel where there was swelling ground, and it was difficult to hold, and they had encountered gas, where some men were killed.

Q. And the timbers were crushed by the swelling ground? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. You did not consider that the area through which the San Pablo Tunnel was constructed was in self-supporting ground, did you?

A. I did not know; but I assumed a portion of it could not have been, on account of swelling ground.

Q. I will ask you to look at Tunnel No. 8, on this diagram,—[730] which is the Franklin Canyon Tunnel, of the Santa Fe—a tunnel approximately a mile long, built about 1899—one of the first large tunnels that was built through the Coast Range in the region of San Francisco Bay. Did you have any knowledge of the difficulties that were encountered and the materials met in the driving of that tunnel?

A. None whatever.

Q. When you were preparing your estimate of the Broadway Tunnel, you made no inquiry regarding the history of that?

A. No. I really did not know, at the time, of the existence of that tunnel.

Q. I will show you tunnels Nos. 10 and 9, which lie—No. 10 lies on the west side of Alhambra Valley; and No. 9, on the east side, where the Santa Fe crosses Alhambra Valley. Those are two short tunnels. Were you familiar with them, when you—

A. I could not have been familiar with them; I did not even know of their existence at the time.

Q. When you were preparing your estimate on the Broadway Low Level Tunnel, did you know that Tunnel No. 11,—which is known as the Walnut

(Testimony of Lewis Michael Larson.)

Creek Tunnel, and which was constructed about 1926 or '27, on the line of the Eastbay Municipal Utility District Aqueduct—did you know about that? A. I knew, by hearsay, of it, yes.

Q. Did you ever inspect that tunnel?

A. I never did.

Q. Do you know what kind of materials were encountered there?

A. No; I do not.

Q. When you made your estimate on the Broadway Low Level Tunnel, did you know about Tunnel No. 6,—the Upper San Leandro Water Tunnel of the Eastbay Municipal Utility District?

A. I did not.

Q. And which is in the City of Oakland, and lies southerly of the Claremont Tunnel and the Broadway Tunnel and the other tunnels which lie immediately easterly of Oakland,—A tunnel somewhat over a mile [731] long?

A. No; I did not. This is the first I ever heard of that one.

Q. You did not know there were considerable difficulties encountered in driving that tunnel?

A. No; I did not know of the existence of the tunnel.

Q. Or you did not know whether that was driven in self-supporting material or not?

A. I could not know, not having known of the existence of the tunnel.

(Testimony of Lewis Michael Larson.)

Q. Did you know of Tunnel No. 5,—which is marked here as the Shepard Canyon Tunnel—the tunnel now used by the Sacramento Short Line,—a tunnel that was built through the hills about a mile southerly of the Broadway Tunnel, in 1911 or 1912, when the Oakland and Antioch Electric Line was constructed?

A. I knew of the existence of the tunnel, yes.

Q. When you were making your estimate of the Broadway Low Level Tunnel, did you make any examination of that Sacramento Short Line Tunnel?

A. I did not.

Q. So, when you prepared your bid, you did not know that that had caused many difficulties in its construction; a number of men were killed; slides occurred?

A. I knew very little about the difficulties that were encountered.

Q. Did you know that timbering was used throughout the tunnel?

A. I did not.

Q. Did you know that they had a slide near the west portal, which extended to the surface and required some 50 or 60 cords of wood to fill up the face of the void above the top of the tunnel?

A. I did not.

Q. When you prepared your estimate of the Broadway Low Level Tunnel, did you have in mind the material encountered in the Lafayette Tunnel

(Testimony of Lewis Michael Larson.)

of the Eastbay Municipal Utility District,—Tunnel No. 4? [732] A. Only in part.

Q. You were in charge of the work in the Claremont Tunnel,—which is shown as Tunnel No. 3 on this map? A. Yes.

Q. The Lafayette Tunnel was constructed contemporaneously with the tunnel on which you were working? A. It was.

Q. But you don't know what materials were encountered in that tunnel?

A. I knew some, yes.

Q. Well, generally, were the materials self-sustaining or not? I am referring to No. 4,—the Lafayette Tunnel?

A. Well, for a period of time, and in different parts of the tunnel.

Q. By that, do you mean a period of time shortly after excavation the material stood without support, and then, as time lapsed, began to require support?

A. That was my understanding.

Q. And the support that you understood, Mr. Larson,—to make it clear,—was support not to prevent the falling of rocks on the men who were working in the tunnel, but to maintain the integrity of the tunnel structure?

A. In part, yes; in fact, mostly so; but I also understood that material there was a softer material than the Orindan encountered in the Claremont Tunnel.

(Testimony of Lewis Michael Larson.)

Q. What kind of material was the Lafayette Tunnel driven through?

A. The major portion, I am told, was through the Orindan. I did not visit very often; I did not see very much of the tunnel.

Q. But that was your understanding: that it was an Orindan that was softer than you found in the Claremont Tunnel?

A. That was the information I had.

Q. You had that information when you prepared your bid on the Broadway Low Level Tunnel?

A. I did; I knew of that.

Q. Tunnel No. 3, shown on Defendant's "B",—the Claremont Tunnel: that tunnel is a tunnel for which you prepared a bid for one man who was not successful; and you prepared an estimate, or a bid, [733] thereafter, for the successful contractor?

A. Correct.

Q. You were in charge of that tunnel in 1926, May or June, I believe you said, and until the fall of 1929?

A. Yes.

Mr. Marrin: Mr. Tinning, may I clear that up? I understood Mr. Larson's testimony to be that he prepared it for a contractor who was not at first successful and thereafter was the low bidder.

Mr. Tinning: I am not trying to make a point of it. I was just trying to ask about the testimony, because I have no notes.

Mr. Marrin: I see.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Q. My understanding of that was you prepared an estimate for one man, and he did not get the contract; and that, later, you went to work for Greer and Meade, as their tunnel superintendent in that construction, and remained in that capacity throughout? A. That is correct.

Q. I thought you mentioned Lindgren and Swinerton? A. Twohy Brothers.

Q. Twohy Brothers? A. Yes.

Q. Before leaving the diagram, there is one other tunnel here that I would like to direct your attention to,—No. 7: the old Highway Tunnel. That is the tunnel you passed through when you were making your inspection of the ground,—the surface conditions surrounding the Broadway Low Level Tunnel? A. Yes.

Q. No. 7. As a matter of fact, when you were building the Claremont Tunnel, in that approximately three-year period, you passed through the old tunnel on many occasions, did you not?

A. I did.

Q. You were already very familiar with that tunnel? A. Reasonably so, yes.

Q. During the same time you were employed on the Claremont Tunnel—By the way, that was driven from both ends, was it not? A. It was.

Q. So, you had to travel from the westerly end to the easterly end [734] frequently, in your work, before the tunnel was holed through?

(Testimony of Lewis Michael Larson.)

A. Well, not before the tunnel was holed through. I was watching the west end excavation, but, after—there was 6000 feet of work—5000 feet of that tunnel driven from the end that I had nothing to with the driving of—but, later on, after the tunnel was driven through, I had occasion to go over there to do some reinforcing work in the tunnel; and that took me frequently through the old tunnel.

Q. Did you, when you were travelling back and forth, in connection with your work, between 1926 and 1929, also use the Fish Ranch Road?

A. I believe, very little. I may have made one or two trips over it.

Q. It was not your usual route?

A. No, no.

Q. The Claremont Tunnel and the Lafayette Tunnel were of substantially the same size and type of construction, were they not?

A. A difference of a foot, I think, in diameter.

Q. The Lafayette Tunnel was a foot larger than the Claremont?

A. I think, the reverse.

Q. Smaller?

A. That is my understanding.

Q. They were both water tunnels?

A. Yes.

Q. Both lined with concrete and with what we call an invert—they had a horseshoe shape above, and that was closed by a semicircle below?

A. I believe that is true, yes.

Q. I think you said the diameter. Both height and width of the finished Claremont Tunnel were 9 feet?

A. That is correct.

(Testimony of Lewis Michael Larson.)

Q. And the excavation was 12 feet?

A. Approximately.

Q. This old tunnel that you testified about, and you have described in your earlier testimony, the old Highway Tunnel, between Contra Costa County and Alameda County, is how big?

A. I would estimate it to be about 16 feet wide; might be a little wider—about 12 to [735] 15 feet high; probably around 14 feet high.

Q. Well, I have made inquiry, and I think your memory is quite accurate. You would not say the figure was wrong, of 17½ feet in the clear, inside, between the timbers? A. No; I wouldn't.

Q. And 15½ feet high? It is certainly very close to your memory. Now, the timbering in this tunnel was 12 by 12. You recollect that?

A. I am not sure whether 12 by 12 or 10 by 10.

Q. As you drove through there, you noticed that these timbers were, in some places near the portals, somewhat distorted by the surface pressures in the surface of the ground, as you got into the interior of the tunnel; and the materials seemed to be standing well, and the timbers, you thought, were the same timbers that were installed in 1903 or 1904? A. That was my conclusion.

Q. From what you were able to observe and from any inquiry that you made?

A. Just my observation.

Q. You made no inquiries to ascertain if there had even been slides, in that tunnel, in which timbering had broken and people had been injured?

(Testimony of Lewis Michael Larson.)

A. I did not.

Q. Were you able to see that there had been a number of timbers replaced in that tunnel?

A. Near the portals, only.

Q. Near the portals. In the center portion of the tunnel, so far as you were able to observe, and in the formation which you said was the chert, you were unable to observe any retimbering?

A. I could not see that there had been anything done in the way of retimbering in that tunnel.

Q. How far apart were those timbers in there?

A. I estimate them to be 4 feet. I am not sure my estimate is correct.

Q. In that tunnel, as you passed through it, did you observe anything to indicate that there had been trouble, by water?

A. Not in the major portion of the tunnel; only at the portals. [736]

Q. What do you consider the portal; how far from the portal would you say falls within that definition?

A. Well, that portion of the tunnel that is effected by operations within, where the result of excavation might influence the structure there; and its extreme limit, I should say, probably is from 30 to 50 feet, depending on which end you are speaking of.

Q. Well, if there is a difference between the ends, please tell me; if you consider one end is a

(Testimony of Lewis Michael Larson.)

greater portion of a tunnel, or if you did consider more of a portion on one end than the other.

A. I would think the weakest portion of this tunnel would be the east end.

Q. Where the overburden is light, and where it is in the Orindan?

A. Well, yes; but probably fractured. Well, I am not sure that that is Orindan, by the way, on that end.

Q. How many feet, on the westerly end of the tunnel, would you consider within the portal area?

A. Approximately 40—between 30 and 40.

Q. Between 30 and 40?

A. Yes; that is a rough estimate.

Q. This Broadway Low Level Tunnel is built in close proximity to the—300 feet below the old tunnel that we have just been referring to? A. Yes.

Q. And the timbers used in the temporary support of the Broadway Low Level Tunnel were of the same cross-section—12 by 12—as the timbers in the old tunnel, were they not?

A. The timbers in the Broadway Tunnel were 12 by 12. If you are sure the timbers in the old tunnel were 12 by 12, I would agree with you.

Q. Well, I think it is, Mr. Larson.

The Court: We will take a recess now.

(Recess) [737]

(After recess:)

Mr. Tinning: Q. Mr. Larson, when you were inspecting this tunnel, the old highway tunnel, did

(Testimony of Lewis Michael Larson.)

you know how that tunel was driven, whether it was driven by the full face method or the wall plate method, or what method was used?

A. I have no knowledge of how it was driven.

Q. Would it have made any difference in your opinion that you formed as to the material through which it was driven if you knew that that tunnel was driven with a crown or top drift, and a bench against which arch timbers are supported by stulls until the plumb posts or vertical timbers were placed under the outer end of the segments?

A. It would not, because I relied on the geologist's report on its being self-supporting ground, consequently I would ignore that fact as sometimes the notion of, and often times that of an inexperienced tunnel man, you cannot judge that the method he used was the proper method and say you could follow the same method.

Q. Do I understand that your opinion as to the ground which was to be encountered in the Broadway Low Level Tunnel was formed from the geologist's report and that likewise that your opinion as to the ground that actually you could see in the old tunnel was formed from the geologist's report?

A. My observation of the ground in the old tunnel and my study of the general conditions, physical conditions there, was, I could not find anything that caused me to conclude that the geologist was wrong in his report.

Q. But his report did not refer particularly to the old tunnel, did it?

(Testimony of Lewis Michael Larson.)

A. It referred to the ground that was anticipated would be found in the new project.

Q. In the project for which you were preparing an estimate?

A. Yes, and that was covered by his report, and it was his report [738] that I relied on.

Q. Now, we are discussing the old tunnel of which you made a visual examination, and which you said previously in your testimony led you to believe that the material to be encountered in the new tunnel would be similar to that in the old tunnel.

A. That as I understood the geologist to say that same body of material, that is, the same cherts, would be encountered as is in the old tunnel; in that respect I felt that we could look for a cherts formation, and the self-sustaining quality of it I judged from what Dr. Louderback said in his report.

Q. In other words, you assumed from Dr. Louderback's report that the cherts that you might encounter in driving the new project would be similar in character and standing qualities to that which you discovered in the old tunnel?

A. No, that would be a misinterpretation of his report, I think.

Q. What did you assume then, Mr. Larson?

A. I assumed that the major portion of the cherts and the orindan, as he states in his conclusion, which was the definition of his previous re-

(Testimony of Lewis Michael Larson.)

marks—that the major portion of the tunnel, particularly as he emphasizes the cherts and the orindan formation would be self-supporting.

Q. I think we are talking about different things. I am asking you what you assumed by reason of your inspection of the old tunnel.

A. That there was no reason to change or doubt the conclusions that the geologist made regarding the material to be encountered in the Broadway tunnel.

Q. Did you regard the ground, the rock through which the old tunnel was constructed, as self-sustaining?

A. I had not formed any definite conclusion as to whether or not it was self-sustaining; that did not enter my mind at the time.

Q. Do you now consider that the material through which the old [739] tunnel was driven was self-sustaining?

A. I could not answer that, frankly.

Q. You used your observation of those materials as a basis for arriving at a conclusion, one of the bases for arriving at your conclusion as to what it would be proper to bid on a tunnel on a project of three and a half million dollars or more?

Mr. Smith: Not three and a half million, but two million.

Mr. Tinning: Q. Did you not form any opinion as to whether or not the material through which the old tunnel was driven was self-sustaining material?

(Testimony of Lewis Michael Larson.)

A. I did not view it in that light. I viewed it in this light, that I would encounter a cherts, and experience teaches underground men that generally the deeper you go into a formation the more self-supporting the material is, and since I had the authority of the geologist, whose opinion in that territory particularly should be as elaborate and sure of being a right conclusion as any that we could possibly get, I could see no reason for changing the thought that he had advanced in his report, after observing the old tunnel.

Q. And your connecting the two was then that the conditions that you observed in the old tunnel were such, coupled with the fact that you were going through a similar material at a deeper level, that these similar materials would be stronger at the lower elevation than they were in the old tunnel?

A. I had a right to conclude that from the geologist's report.

Q. At any rate, you did so conclude?

A. I did so conclude.

Q. Mr. Larson, I show you a photograph—this is one of 12 photographs which were taken of the old tunnel on the 15th of April, last Friday afternoon, and I will ask you if that is a fair representation of the conditions which you saw there when you inspected that tunnel three or four years ago?

A. Might I ask [740] where that is?

Q. That is the westerly portal looking toward the east.

(Testimony of Lewis Michael Larson.)

A. This is the west portal. I think the timbering, as I remember it, was slightly more distorted in the immediate vicinity of the portal, not the batter posts on the outside, but these segments.

Q. I show you a photograph, numbered 2, and ask you if that is a fair representation taken from the north looking toward the south—that would be looking toward the right-hand wall of the tunnel as you go east at the entrance.

A. At the west portal?

Q. Yes. A. I think it is.

Q. I show you a photograph, numbered 3—does it bother you to hold these? A. Not at all.

Q. Which is taken looking at the left-hand or the north wall at the west portal of the old tunnel and ask you if that appears to be a fair representation of the conditions as you saw them in 1934 when you inspected the tunnel?

A. I think so. I notice the timbers here are rotted off, showing they had been there for many years.

Q. I show you photograph No. 4, which is taken from a position inside of the west portal about ten feet looking toward the east and ask you—

Mr. Smith: We will state the situation as we understand it; in 1935, shortly after the slide occurred in the Broadway Low Level Tunnel there was a considerable amount of work in the east portal of this tunnel by Contra Costa County under a contract, and no portion of that work is shown in these photographs.

(Testimony of Lewis Michael Larson.)

(Thereupon a recess was taken while the Grand Jury reported.)

Mr. Tinning: I will continue with the statement. The photographs that I propose to offer here do not represent any portion of the re-timbering which has been done since 1934, so far as I know, and they [741] do not represent any portion of the work that was done in 1935, under a contract with Contra Costa County. If you will look at Photograph No. 4 I have just handed you, there appears to have been some retimbering done in there which I think is some maintenance work near the portal, and within a distance of 30 or 40 feet of the west portal, which was in the area that Mr. Larson stated that he had seen.

Mr. Smith: The only reason I called it to your attention is that the witness should know that it was not intended by you that these pictures were given to him as representative of the conditions existing at the time he went up there, before he made an estimate on the project in 1934, and the fact that the pictures were taken last Friday, that there has been considerable work done on it.

Mr. Tinning: I think I so stated in all my questions, if it was substantially representative of conditions as he found them, and it is only for that purpose.

Mr. Smith: That is all right.

Mr. Tinning: You have seen photographs 1, 2 and 3, and we were just asking you about 4.

(Testimony of Lewis Michael Larson.)

A. Yes, this illustrates the distorted condition of the arch timbers that I spoke of in my previous testimony. They are at a point of almost collapse, and yet at the same time nothing is being done about it which would indicate that the structures did not require much support.

Q. This area which you say did not require much support is in an area near the west portal?

A. It is where the conditions are more difficult than they will be further in the tunnel.

Mr. Smith: You are going to offer the whole group as one exhibit?

Mr. Tinning: Yes, the twelve photographs. [742]

Q. If you will look at the top of the tunnel you will notice that the number of segments in the ring changes from a three-segment ring to a four-segment ring, and apparently as you go east in the tunnel that four-segment ring is maintained as a type of arch to at least as far as the other portal, to where they take up again a portal structure: Is that your memory?

A. Substantially.

Q. I show you a photograph taken on April 15, 1938, looking east away from the west portal along the south wall of the tunnel, taken 75 feet in, east of the west portal of the tunnel, and ask you if that represents the conditions in the tunnel substantially as they were when you inspected it in 1934?

Mr. Wittschen: For the sake of the record will you give the number of that photograph?

Mr. Tinning: That is No. 5, Mr. Wittschen.

(Testimony of Lewis Michael Larson.)

The Witness: I think it is at this particular point.

Q. I show you photograph No. 6, Mr. Larson, which was taken at a point 75 feet inside the west portal, looking toward the west, and ask you if that represents, in your opinion, a fair representation of conditions in the tunnel as they were when you inspected it in 1934?

A. I think it does. Of course, we are now speaking of a permanent timbering aspect where the operation is to be maintained year after year with timbers. I think that point should be emphasized.

Q. Well, at this time I am trying to learn from you whether you think that photograph No. 6 correctly represents the conditions as you saw them, or substantially represents the conditions as you saw them in 1934 when you inspected this tunnel.

A. I believe it does.

Q. I show you photograph No. 7, taken at a point 190 feet east of the west portal looking toward the westerly portal of the tunnel. [743] The photograph shows the south or left wall. Does that represent timbering in the tunnel substantially as you saw it in 1934?

A. In so far as I can tell from a photograph I would say yes.

Q. I show you photograph No. 8, which is taken 430 feet east of the west portal, the camera being approximately at a point on the north side of the tunnel, and I will ask you if that photograph repre-

(Testimony of Lewis Michael Larson.)

sents the conditions in the tunnel substantially as they were in 1934 when you inspected it?

A. I think I remember that particular point there, because there had been no maintenance work done, apparently, in the last 30 years in spite of the pressure as that had become evident at that time.

The Court: Tell me, is the arch here, are the timbers there?

Mr. Tinning: Yes, your Honor.

The Witness: That is a four-foot spacing, isn't it?

Mr. Tinning: I think so, yes. Especially in the center of the tunnel it seems to be. Our measurement indicates they are four-foot centers.

Q. I show you photograph No. 9, Mr. Larson, which is a photograph taken on April 15th, the same point as the preceding one, No. 8, 430 feet from the west portal, looking at the south side of the tunnel, and a view of the opposite side of the same portion of the tunnel that you were looking at in the previous view. Does that substantially represent conditions as you saw them in 1934?

A. I believe it does at that particular point.

The Court: That is to say 8 and 9 are opposite each other in the tunnel at that particular point?

Mr. Tinning: Yes, your Honor.

Q. I show you photograph No. 10, Mr. Larson, which was taken at a point 630 feet east of the west portal, and is a view of the south side of the tunnel. Would you say that that is a fair [744] representa-

(Testimony of Lewis Michael Larson.)

tion of conditions as you saw them in 1934 in the tunnel?

A. At that particular point, yes.

Q. At that particular point, yes. I show you photograph No. 11 taken April 15th, 1938, at a point 505 feet from the west portal of the tunnel looking easterly along the north wall.

Mr. Smith: East of the west portal, but looking east.

Mr. Tinning: Looking east. I ask you if you consider that photograph a fair representation of the conditions that you saw in the tunnel at that point in 1934?

A. I don't see any retimbering done, so I assume that to be the case; apparently it is.

Q. Well, what we had in mind in taking this photograph, Mr. Larson, was the apparent displacement or movement in the seven timbers down or away from the camera.

A. Of course, I have no knowledge whether that is a shift or whether they were placed in that position, and if a shift, nothing had been done about it in thirty years is evident.

Q. Well, I don't know anything about that, either. What I have in mind is just this fact, does it represent——

A. I believe it is a fair representation, yes.

Q. I show you photograph No. 12 which is taken with the camera 680 feet east of the west portal, looking at the south side of the tunnel, and it shows

(Testimony of Lewis Michael Larson,)

in this photograph the considerable spaces between the timbers and the rocks. Is that photograph, in your opinion, a fair representation of conditions as you saw them in the tunnel in 1934?

A. Yes. I note particularly the wall spaces in many places. I think it is a fair representation.

Q. You note the over-break?

A. Yes, but maybe careless shooting, I cannot tell.

Mr. Tinning: If your Honor please, we will offer in behalf of the defendant, as Defendant's Exhibit C, the 12 photographs we have just shown to Mr. Larson, the photographs being 12 in [745] number, and numbered 1 to 12.

The Court: How long was the tunnel?

Mr. Tinning: About 1300 feet, your Honor.

The Court: This was 680 feet, you say?

Mr. Tinning: 600 feet on the west end.

The Court: What is that, an opening there?

Mr. Tinning: Yes. That is where the timbers are standing without support from the rocks.

The Court: What about this?

Mr. Tinning: That is a flashlight picture of the tunnel.

The Court: You see how I was misled.

Mr. Smith: I thought that was an opening, too.

The Court: There are some distortions on these photographs. I don't say it is wilful.

Mr. Tinning: I made an offer, your Honor. I think there is no objection. It is simply demonstrative.

(Testimony of Lewis Michael Larson.)

The Court: They will be admitted and marked.

(The photographs were marked "Defendant's Exhibit C.")

[Set forth in the Book of Exhibits at page 324.]

Mr. Tinning: Your Honor, I made a mistake in figures. The tunnel is 1040 feet long.

The Court: I got misled on it.

Mr. Tinning: Q. Mr. Larson, it is a fact that near the portal of this old tunnel and for a considerable distance toward the east from the west portal, and toward the west from the east portal, that timbers are placed much closer than four feet, is it not?

A. Yes. That is customary near portals.

Q. Yes. That is a fact in this tunnel.

A. I believe it is a fact in this tunnel.

Q. And the timbers, now that we have seen the photographs, you have no difficulty in determining these timbers are 12 by 12 [746] timbers?

A. I believe them to be, yes.

Q. When you commenced to prepare your estimate for the Claremont Tunnel for Twohy Bros. did you go in the field?

A. I made one visit to the portals of the tunnel, proposed portals of the tunnel, but I relied there again on the geological report.

Q. Whose geological report did you rely on?

A. Hulin.

Q. The Hulin geological report?

A. Yes. Dr. Louderback told me he had appointed Hulin to look after that.

(Testimony of Lewis Michael Larson.)

Q. You knew Dr. Louderback at that time?

A. I knew Dr. Louderback shortly after I went to work on the tunnel.

Q. So that at the time you read the Hulin report you were not familiar that he was vouched for, or appointed to this work upon Dr. Louderback's suggestion?

A. I learned that from Dr. Louderback later on.

Q. Did you read the Hulin report on the geology of the Claremont tunnel before you prepared an estimate?

A. I did.

Q. Did that report predict any swellings or heavy ground?

A. I don't recall that it spoke of swelling ground. It spoke of the different formations that would be encountered beginning at the west portal, and I want to remark here that it was remarkably accurate as to the changes, at the points where changes might occur, where uplifts would fracture the formation. In fact, it was a very accurate report, as I recall it.

Q. The Hulin report, then, was very accurate as to where you would pass from one formation into another?

A. That is my recollection, it was.

Q. And that it was also accurate as to where you saw uplifts, that is where some other structure passes up, or came up into the line of the tunnel?

A. As I understand it, the uplift, for example, at the farthest faulted line, the San—I have [747] forgotten the name of that now, he spoke of a

(Testimony of Lewis Michael Larson.)

vertical uplift of 150 feet. To me that meant just that, a vertical uplift, and where we would likely find a fault.

The Court: What do you mean by an uplift?

A. Where one side is stationary and the other one is raised.

The Court: Two different formations?

A. Well, yes. We will say it is like in this position by nature, and something causes one side to rise up vertically.

Mr. Tinning: Q. And his report was remarkably accurate in the prediction of the points at which you would find uplifts and where you would pass from one formation into another?

A. With some exceptions, but in the Orindan and in the cherts that was particularly true. On the west end he spoke of the Franciscan formation for a certain distance. Then we passed into Chico sandstone. Now, there was an intermediate formation in there that no one had anticipated, an old river bed, and then from that into a serpentine, and I believe that was not anticipated by Hulin. He mentioned, however, in his preliminary report, that that section of the tunnel was so covered with improvements and buildings that it was difficult for him to make an accurate estimate.

Q. What was the second formation? You said Chico sandstone and then Franciscan.

A. Franciscan sandstone, and then the Chico sandstone, none of which were anticipated for the

(Testimony of Lewis Michael Larson.)

Broadway Tunnel, so we have to exclude that in our preparation. Then we ran into cherts, which we anticipated to find in the Broadway tunnel, and in that Orindan which we anticipated, and then we ran into a lava in the Hulin report that it was anticipated would not exist in the Broadway tunnel, so we had only two formations that were comparable; that was the Orindan and the cherts.

Q. Claremont cherts in both tunnels?

A. I think Dr. Louderback [748] called them Claremont cherts.

Q. In the Claremont tunnel did you strike the Claremont cherts at the point—let me withdraw that. How far from the point predicted by Professor Hulin did you actually encounter the Claremont cherts when you were driving the tunnel?

A. I think it was very close. I could not tell you in regard to the exact feet, but my recollection is now it was very near the point. There was some little mistake in stationing and I have forgotten.

Q. What do you mean by "very close"? Would you say 500 feet?

A. Oh, no. I think it was within 100 feet, or 50 feet, probably.

Q. Within 50 feet or 100 feet?

A. Yes, that would be the extreme. I am speaking now of the cherts and the orindan.

Q. The Hulin report indicated to you, did it not, that you would require substantial support in driving the Claremont tunnel?

A. In certain localities.

(Testimony of Lewis Michael Larson.)

Q. Was there any place in the tunnel where the report indicated that you would not require tunnel timbering?

A. My memory on that—my recollection on that—is not clear.

Q. Well, do you recollect when you made your estimate whether you figured in any place that you would not require timbering?

A. No. The way I estimated that was that in the plans we were furnished the timbering was stated, the size of the timbering, and the spacing of the timbering, and we were to bid on the placing of those timbers at that spacing, with timbers of that size. As I recall it, there was no designation as to distance that those timbers might go, whether clear through the tunnel or through only a portion of the tunnel. My memory is not clear on that.

Q. Well, in making up your estimate did you assume that timbering would not be required in any portion of the Claremont tunnel? [749]

A. I am not clear on that. I am not sure that I did know.

Q. As a matter of fact, it was required throughout the tunnel, was it not?

A. It was used throughout the tunnel, but not really required in the cherts. If I had known as much about the cherts as I learned after penetrating it I could have left the timbers out except at the fault line.

(Testimony of Lewis Michael Larson.)

Q. How many feet of cherts did you encounter in the Claremont tunnel?

A. My recollection is 1055 feet.

Q. What was the characteristic of that material with respect to requiring support?

A. When entering it we ran into what was termed wildcat fault, that was underneath. We moved through a considerable flow of water. Anticipating that possible trouble I had connected the invert up not to have a soft bottom to operate trains on, and also anticipating possible trouble from oil and gas that the Hulin report indicated might be encountered, I had taken the precaution of putting in about 170 feet of completed rings as a firebreak in case of fire that should develop in the cherts section. When the cherts section was penetrated for a depth of about 120 feet we ran out, as I recall it, of the major trouble in the cherts. We had some difficulty in penetrating it on account of the amount of water. We drove our spiling rather carefully and, as I recall it, traveled through this less soft material and later on it developed when we got to the fault zone that it could be pulled, the wedges could be pulled with your fingers, the wedges that were lying between the places at the corner of the segment and the segment, itself, just to determine whether or not weight came from cherts.

Q. This 125 feet of rings that you installed, was

(Testimony of Lewis Michael Larson.)

that installed in the broken material encountered as you passed through the wildcat fault?

A. No. That was when I knew I was coming to [750] the fault.

Q. That was in the Chico sandstone?

A. Yes.

Q. I mean in regard to the broken area, the broken material which you encountered as you passed through Wildcat fault.

A. I drove in spiling and in some places where necessary I did breastboarding.

Q. In other words, you had a broken material which you faced that you had to use breastboarding to handle the material?

A. Yes. That was particularly true on account of the bad formation that we encountered.

Q. How much water did you have in the tunnel, in this 12 by 12 drift tunnel that you had at this point when you passed out to the end of the cherts?

A. Dr. Louderback, in the geological report—

Q. How much did you have? What quantity of water per minute in gallons?

A. 700 gallons, according to the geological report of Dr. Louderback, on the Broadway Tunnel. He refers back to that.

Q. Did you take any measurement? You are referring now to Dr. Louderback's geological report, which is in evidence.

Mr. Smith: The witness says that the report—

Mr. Tinning: Of course, we are not asking him what the report says.

(Testimony of Lewis Michael Larson.)

The Witness: The district had a weir outside the tunnel where measurement was made on the amount of water. That weir, the District Engineer told me later on, was about 20 per cent. below accuracy. Whether Dr. Louderback took his 700 gallons—that would be the basis of my information, it would have to come from that weir, I have no note at the present time.

Q. Well, how much flow is 700 gallons a minute, how much flow would that give you on the bottom of the tunnel?

A. The invert—I think, possibly 10 inches over the invert was the flow. That is approximate and only an estimate. [751]

Q. Did that mean your tracks were covered by water 10 inches in height?

A. It should be about the top of the rails, in the invert,—where the invert was placed; but, of course, considerably over the rails where there was no invert.

Q. How close were those timbers placed in this area where you were driving the spiling and supporting the roof and sides against this loose material and water?

A. My recollection is 6 feet.

Q. 6 feet?

A. That is my recollection.

Q. Did you have any crushed timbers there, after you set your first sets?

(Testimony of Lewis Michael Larson.)

A. I have a recollection of not going through, that weight, on the timber.

Q. No weight even in that broken area?

A. I was afraid I was going to have weight; and I watched it very closely.

Q. Did you encounter any considerable flow of water in the driving of the timbers?

A. After I passed through the chert, I came into the orindan; I left the orindan, and came into the lava; and, in the lava, I had a very considerable amount.

Q. When you were in the orindan, what kind of conditions did you encounter?

A. Dry and very dusty; and in portions where the silt—as I have observed it, where the deposit, in flood times, in either rivers or lakes, comes—when this dries, it cracks wide open, in that mud portion; and in the other portion, where willows grow, it is a sort of gravel, and that is the conglomerate portion of the orindan.

Q. Do I understand that this material, then, is in layers, in varying thicknesses, where you have these clays, or what you say is mud, usually the mud dries and then you find gravel, and the layers, otherwise, alternate as you go through the material?

A. That was the condition,—running through a layer of probably clay and silt; then you would run into gravel, and so many other [752] materials in it, it caused a conglomerate mass; and then into some more of the other gossan.

(Testimony of Lewis Michael Larson.)

Q. Did these materials stand well?

A. Very well.

Q. Did you have to use timbers on them?

A. I did, as a precaution to the workmen, who were likely to be injured by spalls falling off. There would have been no need for it in the conglomerate sections, as I later observed.

Q. How thick was that section of this mud, as you call it?

A. My recollection is it varied,—75 to 100 feet; and then, 50 to 75 feet of the conglomerate; and then back into the other; probably varied about 100 feet.

Q. Were those layers, when you encountered what you call dry mud—was that a homogeneous layer,—all of the same material for 100 feet, or 50 feet, or whatever it might be?

A. As near as I could observe, it was.

Q. When you got into the gravel, what you call this cemented material—the conglomerate—was that also homogeneous?

A. As I observed it, yes.

Q. In the Claremont?

A. Yes.

Q. When you got into the lava, what did you encounter?

A. I encountered a usual broken formation that you find in lava rock,—a soft, easy-drilling rock; and in this particular case, it carried a great quantity of water.

(Testimony of Lewis Michael Larson.)

Q. What quantity of water did you encounter in that tunnel?

A. I think the weir I spoke about recorded 4,000 gallons per minute, or a little bit better. I would say it would be about 5,000 gallons per minute, all told.

Q. What kind of a stream flow did that give you on the bottom of the tunnel? [753]

A. The motors that we used,—five-ton motors,—when they would be going against the current, the men riding on the motors had to raise their feet up on top of the motor, in order to clear and keep them from being washed by the water. In going out of the tunnel, with the direction of the flow toward the west portal and downstream, of course the water would reach up and cover the wheels for about 18 inches.

Q. In other words, you would have, above the tracks, water somewhere in the vicinity of 18 inches or so?

A. That is my guess.

Q. What grade was the tunnel on?

A. .00076.

The Court: We will take an adjournment until tomorrow morning.

(Thereupon, an adjournment was taken until Wednesday, April 20, 1938, at 10 o'clock a. m.) [754]

(Testimony of Lewis Michael Larson.)

Wednesday, April 20, 1938

Mr. Marrin: If your Honor please, on page 289 of the transcript of the proceedings of yesterday there appears this ruling:

"The Court: As a legal matter I will sustain the objection, the objection is good,"
and no exception appears to be noted in the transcript.

The Court: At what point was that?

Mr. Marrin: That is when we were talking about the admission of a recast which Mr. Orselli made of the Larson estimate.

The Court: If my memory serves me I indicated that I would sustain the objection at this time.

Mr. Marrin: That is correct.

Mr. Wittschen: I would suggest that the record show that Mr. Marrin took an exception to the ruling.

The Court: I made the ruling, if my memory serves me, that I would sustain the objection at this time. Is that disclosed in the record?

Mr. Marrin: I think it is.

The Court: I want to know. I have a definite state of mind. I want both sides to have a record on any disputed point. Read the record.

(Thereupon counsel read the record.)

The Court: That is sufficient. That is the reason I said I would sustain the objection at this time. You may renew your offer at any other time that you see fit, and at that time I shall consider it. That

(Testimony of Lewis Michael Larson.)

is what I had in mind at that time when I used the language "I sustain the objection at this time," that it would not preclude you at any future time you saw fit when you develop the facts to make any offer.

Mr. Marrin: The only point I had in mind is the first time [755] your Honor ruled on the matter the record does not show we note an exception.

The Court: All right, let the record note an exception.

Mr. Alexander: May we also on behalf of the Cross-complainant note an exception?

The Court: Very well, let the record note an exception in both instances.

LEWIS MICHAEL LARSON,

Cross Examination (Resumed)

Mr. Tinning: Q. Mr. Larson, going back to the Claremont Tunnel, in the preparation of your estimate you said that you made one visit to the site of the tunnel, as I understand it. Is that the fact?

A. That is my recollection.

Q. And only one visit?

A. I recall only one, as there were just a few portals that were visible, portal locations.

Q. Did you at the time you prepared your bid have available for your use a copy of the geological report of Mr. Hulin, that you referred to?

A. It is my recollection that I had that.

(Testimony of Lewis Michael Larson.)

Q. Including the maps attached to it, profiles of the tunnel, showing the formation?

A. I believe I had, that is my recollection.

Q. Was there any mention made of those in the specifications?

A. I could not say definitely "Yes" or "No" to that question.

Q. I believe you said yesterday that to the best of your recollection the Hulin report did not predict heavy or swelling ground.

A. That is to the best of my memory.

Q. Did you consider you were misled by the Hulin report?

A. Well, possibly, but my estimate not having been used, or not being the one that landed the bid, I thought that would be immaterial. [756]

Q. Well, the question now is not whether it was material, but were you misled by the Hulin report?

A. I rather think that the developments later on would lead me to believe that the Hulin report did not cover all the difficulties that might be anticipated, in fact I think it minimized the difficulties.

Q. Now, is it your present statement, then, that you were misled by the Hulin report?

A. I think it would be better stated, that I did not comprehend all the difficulties from having read that report, that the report, itself, was not comprehensive enough to go into all the details; it went into many of them, some of which I believe varied slightly from what was predicted by Mr. Hulin, but others quite materially.

(Testimony of Lewis Michael Larson.)

Q. Yesterday you stated that it was a remarkably accurate report.

A. As to location of changed formation.

Q. And that it was accurate to the best of your recollection within the limits of 50 to 100 feet in its prediction at what place you would pass from one formation to another?

A. That is my recollection.

Q. Did the man who built that tunnel abandon the work because the Hulin geological report was misleading?

A. He did not abandon it for any reason.

Q. He completed it?

A. He completed it.

Q. And he met the difficulties which you say were not outlined in the geological report?

A. He met any difficulties that developed.

Q. When you were preparing this bid did you consult the chief engineer of the district, Mr. Davis?

A. I did not.

Q. When you were preparing this bid did you consult F. W. Hanna, the designing engineer of the East Bay Municipal Utility District?

A. I did not.

Q. When you were preparing this bid did you consult Mr. Munn, the [757] engineer in charge of the work?

A. Not at that time.

Q. Not until after the contract?

A. No.

(Testimony of Lewis Michael Larson.)

Q. In other words, in preparing that bid you had the specifications, the geological report, and your general knowledge of tunnels gained by your years of experience?

A. That is true.

Q. And at this time you cannot tell us whether you were misled by Mr. Hulin's report or not when you prepared that bid?

A. I think the use of the word "misleading" does not quite carry the thought that I had in mind; any report, if you run to the point of splitting hairs, you might say is misleading one way or the other; in general, the difficulties that were encountered were greater than those that I had drawn the conclusion would be encountered from reading the report, the Hulin report.

Q. A few moments ago you said that a man must be able to comprehend the report when he read it; that is true, is it not?

A. That is a matter of degree, again.

Q. Of experience?

A. Yes.

Q. Were there any drifts or test holes or borings at the site of the Claremont Tunnel?

A. No, not that I have any recollection of.

Q. When you were preparing your bid did you examine the cherts outcrop of the Fish Ranch Road which you examined when you were preparing your bid for the Broadway tunnel?

(Testimony of Lewis Michael Larson.)

A. At that time I did not know of this outcrop on the Fish Ranch Road.

Q. That outcrop on the Fish Ranch Road is nearer to the Claremont Tunnel than it is to the Broadway Tunnel, is it not?

A. That is my belief.

Q. The map shows, does it not, Defendant's Exhibit B, that the Claremont Tunnel passes very close to the outcrop?

A. I do not question that, I have never checked up on that, but I think that is a reasonable conclusion.

Q. From your general knowledge of that topography that is true? [758]

A. Yes.

Q. When you prepared the bid for the Claremont Tunnel did you consider that the ground in the tunnel would be self-supporting?

A. I cannot recall at this particular time the thought that I had as to that ground. I do recall that the district, the East Bay Municipal Utility District, prepared plans showing the type of timber that was to be used or the size of the timbers, and the spacing of the timbers, but whether I connected that with the full distance of the tunnel, I have not any clear recollection of at the present time.

Q. What was the spacing shown on the timber plan that you refer to?

A. As I remember it, two feet centers.

(Testimony of Lewis Michael Larson.)

Q. You have looked at that plan since yesterday, haven't you?

A. No, I have not.

Q. I think you stated yesterday that they were 4-foot centers.

A. No, I think that is a mistake, 2-foot centers and 8 by 8 timbers.

Q. And it also showed a plan immediately following the one you have referred to of circular timbers for heavy ground out of 12 by 12 timbers, did it not?

A. That is possible. I have not any clear recollection on it.

Q. And the specifications also required the contractor to place timbers of any size requisite to support the tunnel during construction?

A. That is true.

Q. That was also true of the Broadway Low Level Tunnel?

A. I think the difference in the two tunnels in the specifications lies in this, that there was no intimation in the specifications that the timber should be removed; I think in the geological report that there was no statement that the tunnel ground would be self-supporting, as it was in the Broadway.

Q. In other words, the distinction that you now draw between the [759] specification in the Claremont Tunnel and the Broadway Tunnel is in the case of the Claremont Tunnel the specifications did not call for the removal of the timbers and the plans

(Testimony of Lewis Michael Larson.)

did provide for the timbering of the Claremont Tunnel, is that correct, while in the Broadway Tunnel no plan was provided, and there was also a provision which you say called for the removal of the timbers?

A. That was my understanding of the specifications, yes.

Q. And when you read those Broadway Tunnel specifications you also read the provision that it could be removed or should be removed by the contractor if the District Engineer required it?

A. No, I would not state it that way, that it would be permitted to remain in if the District Engineer permitted it.

Q. If he permitted it?

A. Yes.

Q. You read that provision?

A. I read that provision.

Q. Now, I was going back to the Claremont Tunnel, you testified that there were two comparable formations in the Claremont Tunnel with those that were predicted for the Broadway Tunnel?

A. That is correct.

Q. And as I understand it you meant by that the cherts and the Orindan?

A. Those are the two that I meant.

Q. As a matter of fact, there was considerable volcanic material predicted in the Claremont tunnel, was there not?

A. That was in the lava formation; it is not existant in the Broadway Tunnel.

(Testimony of Lewis Michael Larson.)

Q. I did not hear.

A. That was in the lava formation which does not appear in the Broadway.

Q. It does not appear?

A. It did not appear at all in the Broadway.

Q. I understood you to testify that you had read the Louderback report from pages 13 to 19, Mr. Larson, that is the part dealing with the tunnel.

A. I think you are right. [760]

Q. I will ask you to look at Plaintiff's Exhibit No. 22, at page 14, and will ask you if you read this paragraph—I am reading the first paragraph,—headed "Claremont Cherts."

"After leaving the sandstones the prevailing formation for about 1200-1300 feet, is the Claremont Chert (called Claremont Shales in the San Francisco Folio of the U. S. Geological Survey). This formation consists chiefly of a series of alternations of layers of chert from 2-6 inches or more thick, and somewhat thinner layers of siliceous shale. Occasionally a layer of clay shale, sandstone, siliceous ferruginous limestone, or volcanic ash is encountered."

When you read this report did you observe the reference to volcanic ash?

A. I believe that I observed all that was in the report, and then I took Dr. Louderback's—

Q. Just a minute.

Mr. Smith: Just a minute, let him finish.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: I have a right to have an answer.

The Court: Answer the question and then explain.

Mr. Tinning: Q. Did you read this paragraph?

A. I did read this paragraph.

Q. Now make any explanation you wish.

A. And then I read through all of the details and at the conclusion entitled on page 18, "Tunnels in General," the geological summary or definition of all of the preceding.

Q. You took the definition instead of the detail, that is a summary of your testimony?

A. I surely did, because that was his interpretation of his own remarks.

Q. That was your conclusion?

A. Yes.

Q. But you observed in the Louderback Report when you were preparing your bid the reference to volcanic ash which appears on [761] page 14 of Plaintiff's Exhibit No. 22?

A. I did. I read all of those general remarks.

Q. Now, we will return to the Claremont Tunnel. It is true, then, that in addition to the two formations predicted in the Claremont Tunnel you referred to, the cherts and the Orindan, that there was another formation predicted of lava, in which you found volcanic ash when you drove that tunnel?

A. Yes, I found the volcanic ash as interpreted to me at that time as volcanic ash on the contact between the Orindan—as a matter of fact it was

(Testimony of Lewis Michael Larson.)

after we had passed into the lava formation, within a distance of 60 feet before we encountered that volcanic ash, that was lying in the volcanic formation.

Q. And likewise in the driving of the Broadway Tunnel volcanic ash was encountered, was it not?

A. I could not say to that, I don't know that it was.

Q. You don't know that it was?

A. I don't know that it was.

Q. That might have been encountered after you left. You know what you went through while you were there?

A. I believe I do.

Q. Now, the Hulin report, to refresh your memory with reference to the cherts reads as follows:

"Station 108-118, thickness 1,000 feet"——

Mr. Smith: What are you reading from?

Mr. Tinning: The Hulin report.

Mr. Smith: I thought you were reading from something else.

Mr. Tinning: This is the Hulin report.

"Claremont Cherts. Consist of thin layers (1 to 3 inches) of hard but brittle cherts, interbedded with thin ($\frac{1}{4}$ to $\frac{1}{2}$ inches) layers of shale. A few beds of sandstone and extremely hard, tough limestone occur; thickness 1 to 3 feet. The cherts will be hard on drill steel." [762] You knew that from past experience?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. "But due to their brittleness should break well." I suppose by "breaking well" it means cut off so that you will get a clean line of breakage instead of breaking over a large over-break?

A. It refers particularly to the shattering, that it shatters well.

Q. So that by use of powder you can take it out without having too large pieces to handle?

A. That is correct.

Q. "They should stand well and require little timber. Since the beds stand practically vertical no trouble from slabbing should occur." "Slabbing," I understand, is horizontal or nearly horizontal layers that might fall because those layers were standing more or less vertical?

A. Yes.

Q. You would not have that to contend with?

A. That is generally true.

Q. "The cherts are bounded on the west (Station 108) by a major fault line. The fault is located with a probable accuracy of 50 feet." What I read to you is from page 5 of the Hulin report. Do you remember that?

A. In general, yes.

Mr. Smith: I suggest that the witness be allowed to look at it.

Mr. Tinning: It is a document of the District. I will let him look at it. I have no other copy.

Mr. Smith: You are asking to test his memory on a document he looked at 12 years ago.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: That will not make any difference. He can look at it if he does not think that is right.

A. I think it is [763]

Mr. Tinning: Q. It has been some time since you have seen it, but you don't question that that is a copy of the report?

A. No; I really think it is.

Q. Will you look at the back of it and see the diagram in the back?

A. I think that is a true representation.

Q. You think that is the report?

A. I do

Mr. Smith: I don't question the report. I just imagine the witness has not seen it for many years, and was entitled to see what you were bringing out.

Mr. Tinning: Q. On page 6 of the report, under the heading "Gas Problems," we find the following matter with respect to the Claremont cherts:

"The Claremont cherts between these stations—" and they are referring to Stations 108 and 118—

"The Claremont cherts between these stations belongs to the formation which is the source of much of the oil in California. The cherts of this belt, even on the surface, have an appreciable bituminous odor. While the structure here is not favorable for the accumulation of great quantities of gas, it is practically certain that some gas will be encountered.

(Testimony of Lewis Michael Larson.)

"It will be recalled that the explosion which occurred in the San Pablo-Wildcat Tunnel of the East Bay Water Company a few years back resulted from gas derived from this same group of rocks, and under very similar structural conditions."

I believe that the Wildcat or San Pablo Tunnel, which is shown on that map as No. 2, Defendant's Exhibit "B," the tunnel you said you had knowledge of when you prepared your bid on the Claremont and also when you prepared it on the Broadway Tunnel—

A. I had some knowledge,—rather indefinite.
[764]

Q. Then, under the heading of "Water Problems" on page 7:

"Water in quantity need not be expected except between Stations 66 and 88."

Those stations are the stations within which the lavas appear on the map?

A. Yes.

Q. "The lavas, the predominant rocks between these stations, are prone to be traversed by numerous fractures, the result of folding and also shrinking on cooling. The rocks therefore tend to contain numerous open waterways. The interbedded fragmental volcanic material, likewise, tends to be porous.

"The structure between Stations 66 and 88, that of a syncline or basin, is decidedly favorable for the accumulation of water, diverting

(Testimony of Lewis Michael Larson.)

all the surface drainage of the area underlain by the lavas towards the trough of the fold.

"It may be pointed out that the wells of the East Bay Water Company in Upper Wildcat Canyon, and also the numerous springs which occur on the east slope of the range (Stations 50 to 60) derive their water from these lavas. The flow of water from the lavas which may be expected in the tunnel may be expected to have some effect on the ultimate producing capacity of these springs and wells.

"Water derived from these lavas in the tunnel may be expected to be quite free from surface pollution, and might well be added to the water supply of the Utility District."

As a matter of fact, you recollect reading this?

A. In detail, it is refreshing my memory.

Q. It is refreshing your memory, as we go further. As a matter of fact, in the lava, you got practically up to the amount of 4,000 gallons per minute of water?

A. Yes; that amount registered on the weir.

Q. In the chert—Mr. Hulin's report then refers to water in the [765] chert, in the portion headed "Water Problems." In the chert, you got up to 600 gallons per minute?

A. According to Dr. Louderback's report, respecting the Broadway Tunnel, he reported 700 gallons per minute.

(Testimony of Lewis Michael Larson.)

Q. I am asking you if you do not recollect, in your own information, the data you gathered as you went further.

A. I think that is approximately correct.

Q. So that you had a great deal of water in the chert, and I think you told us yesterday sometimes you had as much as 10 inches above the top of your rails?

A. At times——

Q. I understand. You are correct. When you went through the chert, you had 600 gallons per minute of water, and it came up about to the top of the rails?

A. Yes, according to my recollection.

Q. And in this Hulin report, you have no recollection anywhere of seeing anything regarding there being heavy, moving or swelling ground?

A. I have not, at this distance, any recollection.

Q. You mean distance in time?

A. Distance in time, yes.

Q. Not distance from me?

A. No.

Q. So far as you know, there is nothing in the report?

A. So far as I know; I don't remember there is anything in it.

Q. Well, I think you are correct.

A. It might be full of it, for all I know. My recollection is not clear on it.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Your Honor, this report—we have no copy of this report; but I have marked up my working copy, and I have marked this up, and I am going to prepare another one, and, with counsel's cooperation, I will ask to offer it at a later date.

The Court: Very well.

Mr. Tinning: Will there be any—

The Court: You can offer it, and withdraw it, if you wish. You may offer it for the record, if you wish. [766]

Mr. Tinning: Well, we will then offer the Carlton D. Hulin report, dated April 27, 1926, entitled "Preliminary Report Upon the Geology of the Claremont Tunnel, East Bay Municipal Utility District."

Mr. Smith: What is the date of that, Mr. Tinning?

Mr. Tinning: April 27, 1926; to which is attached a Claremont Tunnel geological map. May I ask to have this marked Defendant's Exhibit "D"?

(The documents were marked "Defendant's Exhibit "D.")

[Set forth in the Book of Exhibits at page 337.]

Mr. Smith: It will be received preliminarily until we have a chance to examine it, will it, your Honor?

The Court: Yes, subject to any correction.

Mr. Smith: May we take this copy, your Honor, over the noon hour?

The Court: Certainly.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Mr. Smith, I would like to have that back for a moment. I have some other examination that I desire to use it on. This, gentlemen, is a copy of the geology map attached to the Hulin report; and I am going to hand this to Mr. Larson.

Mr. Smith: You state it is a correct copy?

Mr. Tinning: It is a photostat.

Q. Mr. Larson, where, on that map, at what station, is the westerly boundary of the chert formation; on what station does that appear?

A. Approximately at Station 122—no; I am reading the wrong way. Station, approximately, 118.

Q. 118. Where is the easterly boundary of the chert shown?

A. Approximately at Station 106.

Mr. Smith: The stations are from east to west on that?

The Witness: Yes.

Mr. Tinning: Yes. [767]

Q. Mr. Larson, don't you think you had better check that last statement? I think that the station numbering is quite some distance below the tunnel line and the easterly boundary of that chert formation is at about 108, when projecting it out?

A. Yes; you are correct on that.

Q. Yesterday, you stated you felt, and you have again today, that Mr. Hulin's report was remarkably accurate in determining the location of various strata. Isn't it a fact that you first encountered the chert at 121 plus 90 or 92?

(Testimony of Lewis Michael Larson.)

A. I haven't any recollection of that.

Q. Well, if that was the fact, it would be that he missed it by about 400 feet, wouldn't it?

A. Assuming your statement, yes, that would be correct; but let me draw attention, again, to something I noted yesterday: There had been a mistake, somewhere in there, on the stationing. With that correction of the stationing taken into account, my recollection is that his location of the fault lines was reasonably close.

Q. I don't know what mistake there was. This is the document.

A. Yes. I recalled, at the time, that there was a mistake in stationing. I got this information from Dr. Louderback.

Q. Later on——

The Court: Pardon me. So I may follow the testimony: He suggested there might be 400 feet. The way I got it from your testimony on that, yesterday, was——

Mr. Tinning: 50 to 100.

The Court: That is what I thought.

The Witness: Yes, from 50 to 100.

Mr. Tinning: Mr. Larson said he thought there was some mix-up in stationing. He did say that at the time.

The Court: I just wanted to follow the testimony. [768]

Mr. Tinning: Q. On the east end, it was true that the locations, as you drove east through the

(Testimony of Lewis Michael Larson.)

cherts and passed out into the lavas—that the locations which you later encountered—that was about 300 feet west of the location shown on Mr. Hulin's map?

A. I cannot answer that, from memory. I believe that I do have records at Santa Cruz, which are not right now available to me, that will tell me and give a more accurate answer to this.

Q. You said that Dr. Louderback told you there was some mistake in the stationing?

A. I think it was he, yes.

Q. During the time you were constructing the Claremont Tunnel, did you frequently see Dr. Louderback?

A. Quite frequently.

Q. Where? A. In the tunnel.

Q. You called him out there sometimes when you had problems, didn't you?

A. No. His visits were all voluntary.

Q. His visits were all voluntary? A. Yes.

Q. You never called him at night when you had grumblings and rumblings underground in there?

A. I had no recollection of it.

Q. Have you any recollection of times when gas was shaking up the ground and giving you all kinds of trouble in there?

A. I think that was prior to this time when we encountered the cherts. That was in the Chico sandstone.

(Testimony of Lewis Michael Larson.)

Q. I am talking about the whole tunnel. When you were driving through the Chico sandstone, before you got to the chert?

A. When we were driving through the Chico sandstone, we had considerable methane gas; but I don't recall we ever called Dr. Louderback. His visits, I believe, in every case—except he might have been called by the district—were voluntary visits.

Q. In other words, he was out there frequently, and it is your recollection that you never called him, that he came out there to look it over?

A. That is my recollection. [769]

Q. Isn't it true you consulted him as to your problems and what you might require as you drove in?

A. I tried to get him to answer those, but he took a most conservative position, that he could not look into the ground forward; that is my recollection: that the surface or top of it was what he based his information on. I will say this for Dr. Louderback—because it has an important bearing on the confidence I placed in his report: that he was very painstaking in recording what he saw in the Claremont Tunnel.

Q. Were you painstaking in recording what you saw in the Tunnel?

A. Reasonably so, from a construction superintendent's point of view; I should say, unusually so.

Q. You made a report on what you saw in the

(Testimony of Lewis Michael Larson.)

tunnel to Dr. Louderback after you got through, didn't you?

A. I did; at his request, yes.

The Court: We will take a recess for a few minutes.

(Recess)

Mr. Tinning: Q. I will show you a document, which I think is an original document.

A. That is my signature.

Q. That is your signature?

A. Yes.

Q. It is a letter addressed to Professor George T. Louderback, University of California, Berkeley, California, February 26, 1929. Now, on our understanding, gentlemen, I assume it will be satisfactory to use a photostat copy, instead of introducing the original letter?

Mr. Smith: No objection.

Mr. Tinning: If the Court please, we offer as Defendant's Exhibit "E," the letter written by Mr. L. M. Larson, to Professor Louderback, on February 26, 1929,—a report of conditions and methods used by Mr. Larson in driving the Claremont Tunnel.

The Court: It will be admitted and marked.

[770]

(The letter was marked "Defendant's Exhibit E.")

[Set forth in the Book of Exhibits at page 349.]

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Q. Mr. Larson, taking this letter up, section by section, I will read as follows:

"My dear Professor: In the following summary of conditions and methods used in meeting them, in the excavation of the Claremont Tunnel, I have endeavored to give station numbers where I had such in my possession; otherwise, set numbers."

I assume by "set numbers," you are referring to the timber sets?

A. Yes. We numbered each individual set, as it was placed.

Q. And, as we have already discovered, from looking at the Hulin map,—the Hulin geology map, which is attached to Exhibit "D,"—the stations started to the east on this tunnel; that is, over at San Pablo Creek, and ran toward Oakland; and you were driving from Oakland towards San Pablo Creek?

A. That is correct.

Q. So, there is usually a subtraction involved in trying to get coordinated with the stations shown on the Hulin map? A. Yes.

Q. Reading further:

"It has appeared to me to be better for me to follow the order of progress rather than that of stationing, although that involves working against the station numbering.

"We encountered a small amount of water

(Testimony of Lewis Michael Larson.)

after penetrating about 20 feet from the west portal, but the ground was firm enough to avoid spile driving or breastboarding."

In other words, you did not have great difficulty getting underground in the initial step; that is what that refers to?

A. Not unusual difficulty.

Q. "At approximately 100 feet in, as I now recall it, we encountered the formation noted in Mr. Hulin's report as silica-carbonate rock. This was blocky, overbreaking in many cases, considerable."

You have a copy of this map in your hand?

A. Yes. [771]

Mr. Tinning: Your Honor, it may be a little helpful, and illustrating matters that we are going to refer to, to have before you the map that is attached to Defendant's Exhibit "D,"—the Hulin geology map.

Q. The formation referred to in this portion of that letter was the Chico sandstone, was it not?

A. My recollection is that was the Chico sandstone which began at 171 plus 50, didn't it?

Q. Well, in other words, it began, as shown on this map, at 171 plus 60?

A. Yes.

Q. You state that, when you were about 100 feet in, you encountered silica-carbonate rock?

(Testimony of Lewis Michael Larson.)

A. I think that was what we termed the Franciscan.

Q. That is what you referred to yesterday as the first formation? A. Yes.

Q. "At a distance in of approximately 700 feet, sand and well-rounded gravel, the latter of a probable maximum dimension of approximately 3 inches, was encountered, carrying some water, probably about 40 gallons per minute."

Is this sand that you refer to there the stream bed you said yesterday you had encountered?

A. Yes.

Q. That was in this area shown as the Chico sandstone? A. Yes.

Q. On this map, that is the second section running from 171 plus 50 to 118?

A. Yes. Let me comment here: that that is in that territory that Professor Hulin says was so covered with improvements that he could not make an accurate survey.

Q. Yes. You made, at that time, no objection or claim that you were misled by the geology report in that he had not predicted this?

A. No; we did not make any such claim.

Q. "No shooting was done in this formation, which extended for approximately 165 feet. There was some clay in the sand, and gravel [772] content; but the standing condition was

(Testimony of Lewis Michael Larson.)

avored by an overlying strata of almost pure clay that almost followed to line of top of cap."

Do I understand that there was a clay bed above the gravel which happened to lie just about on the line of the top of your timbers?

A. Yes; that is the correct interpretation.

Q. So, while the gravels were loose, and you could take them out with tools, without using powder, that is a tight material above that did not cave?

A. Yes; that favored our progress.

Q. "When we passed through this, we encountered about 20 feet of a rather easy-breaking, reddish rock that required light blasting, but offered no unusual difficulties.

"The contact beyond this formation was a sort of 'gumbo' that mined easily and stood well for a short period, when swelling began and it was necessary to relieve pressures wherever possible to prevent breaking of the timber."

That was in this Chico formation, was it not?

A. Yes.

Q. And it was not in any place where Dr. Hulin predicted you were going to find swelling ground?

A. It was in the portion where he said he had not made a study of the conditions because of the improvements.

Q. "In some cases this corrective was not sufficient, and retimbering had to be done intermittently for about 80 or 100 feet."

(Testimony of Lewis Michael Larson.)

In other words, you had timbers that broke, and you had to relieve them, by putting in other timbers between them, did you not?

A. That is the correct interpretation.

Q. "This heavy, constant pressure gradually lessened as we proceeded with our excavation up to Station 164."

Station 164 would take you about one-third of the way through the Chico sandstone,—the second formation shown on the map?

A. No; [773] 164 would be hardly penetrating—

Q. I am using the wrong method, again. It would be about how many feet into the Chico?

A. Well, let me see—from 72 to 60—between 77 and 62—800 feet—wouldn't it be?

Q. About 800 feet in? When you say from 72 to 84, you mean from 172 to 184?

Mr. Smith: To 164.

Mr. Tinning: Q. Well, you had to retimber—and, by the way, do you recollect whether you had to carry the timbers in this portion of the tunnel,—the second design as shown in the District's plan; the circular design?

A. We did not.

Q. You were able to hold it by a U-shaped plan and two vertical posts?

A. Yes; a five-segment arch.

Q. Were those posts vertical or battered?

(Testimony of Lewis Michael Larson.)

A. Vertical, yes. I might mention, there: when I became superintendent, I offered a suggested change to the District, which changed the posts from an inclined post to a vertical post, and allowed the position of the cap to be in a horizontal position at the top, instead of divided; and it was easier to construct it,—that is, the division should not be made at the center; and the District accepted my design.

Q. They permitted you to use that?

A. Yes; and they changed their own design.

Q. "At that point—"You are referring to station 164—

"we encountered better standing ground, that offered no unusual difficulties. Slight quantities of water were encountered at intervals up to about Station 160, where the shale began to show the presence of gas in small quantities. The gas increased slightly as we proceeded forward, being most noticeable where the shale formation was broken with soft sandstone carrying a small quantity of water.

"The shale worked easily and stood well for a short period, [774] giving us time to erect 6-foot sets after mucking out, the spiling was placed immediately after shooting.

"At Set 636, a run of small particles of comparatively clean sandstone, forced out by a quantity of water, sufficient to flood the tunnel to a depth of a foot for a distance of several hundred feet occurred at the end of the spiling

(Testimony of Lewis Michael Larson.)

just as preparations were being made to erect the set. About three hours thereafter there was a gas explosion that injured a number of workmen. It appears that the gas ignited as it was entering the tunnel, because the flames concentrated about the point from which the run came, and appeared to have pressure behind it."

How many men were injured in that accident?

A. Twelve. [775]

Q. There was an accident in the eastern part of the tunnel in the cherts where there were some ten or eleven men killed, was there not?

A. That was a matter of drowning. The people that were driving the Lafayette Tunnel had it bulkheaded effectively against the entry of San Pablo Creek coming into the excavation; an unusual storm came, I think the heavy storm recorded came on Thanksgiving Day and it exceeded any amount that had ever flown before in San Pablo Creek, and it proved that the barricade erected by Smith Bros., who were the contractors on the Lafayette Tunnel, was not sufficient to hold that tremendous amount of water, and it flowed into the screening chamber that separated the two tunnels and then flowed into the Claremont Tunnel; the workmen had just had their Thanksgiving dinner and were just going to work, and when this big flow of water struck them, but that was a condition that was outside of the expected or controllable features of this work.

(Testimony of Lewis Michael Larson.)

Q. As a matter of fact, as long as you have gone into it regarding the state of the flood, it was the contention made and the evidence established the fact that a similar quantity of water had flowed in San Pablo Creek before, and that there was an open adit from the east end of the Claremont Tunnel on the bank of San Pablo Creek above this station, and that the water raised and went into that soft earthy material and went into the tunnel and flooded it. I am not trying to blame anyone.

A. I think that is substantially correct. The tunnel was open at the end at the request of the engineers, so that they could back sight.

Q. Now, coming back to the Chico sandstone:

“From that point forward gas and water appeared together when the disintegrated sandstone was encountered, though in lesser quantities. A year or [776] so after having passed through this formation weight began to show in the vicinity of sets 330 to 345 and 562 to 586, 619 to 634, 816 to 823, 984 to 1002. Relieving sets were erected to hold the ground.”

Now, in the Claremont Tunnel apparently the area that you referred to in this Chico sandstone stood under the original timber about a year before strains and stresses began to be indicated: is that correct?

A. If I recall correctly there were no unusual stresses noted in the Chico sandstone formation. I

(Testimony of Lewis Michael Larson.)

would have to refer to these sets to know just where they are. It may be that some of them were there, but the important fact is to say that it did stand for a year without lining.

Q. Without the permanent concrete lining?

A. Without the permanent concrete lining, yes.

Q. At the end of the year it was beginning near these various points to show strains and stresses?

A. Yes.

Q. As indicated by your report?

A. Yes, where indicated by the report.

Q. This was in the Chico sandstone formation because, if you will note the next paragraph of your letter carries you from the Chico sandstone, as you drive east into the cherts.

A. Yes.

Q. "At station 123 plus 31 to 121 plus 91, from whence we merged from the Chico sandstone section, as noted by Mr. Hulin, to the chert, concrete invert and arch were poured to take care of a ground swell and consequent weight, and to act as a deterrent to a spread of fire if oil were encountered in the cherts."

Do I understand from that, Mr. Larson, that you emerged or passed from the Chico sandstone through the Wildcat Fault and into cherts at station 121 plus 91?

A. That would apparently be the proper interpretation; it was either that or we were right ad-

jacent to [777] it. My memory is not too clear on that.

Q. You would not think if the construction record of the District shows it passed into the cherts at 121 plus 87 that either of you were very far wrong?

A. No, this was approximately where that error in station occurred. I am just assuming that, knowing that there was one.

Q. You are assuming that, but you cannot explain why it was? You have not that knowledge?

A. No, I have not that knowledge.

Q. According to Mr. Hulin's map, the point which in your own letter to Dr. Louderback you give as station 121 plus 91, that was about 400 feet, 391 feet from the point where Mr. Hulin predicted it would occur. Yesterday you testified that before you passed from the Chico sandstone into the cherts you installed about 175 feet of concrete lining as fire break. Your letter, you will note, states, "To take care of a ground swell and consequent weight."

As a matter of fact, you were having considerable difficulty going through that section, weren't you, before you got into the cherts?

A. No, we were not.

Q. You were not?

A. No. That was a secondary consideration. That was one of the reasons, or the first reason, and the real, the only reason for putting that in was in anticipation of encountering possible oil or gas that would light a fire and allow that to come back, be-

(Testimony of Chad F. Calhoun.)

cause we had many places much worse than this where we did not concrete.

Q. You say it was a secondary consideration, but it appears in your letter as a chief consideration, does it not, ground swell and consequent weight?

A. Yes. I am giving you that as a real reason.

Q. "We have made it a plan to stop excavation and pour invert whenever water of sufficient quantity was encountered to make track maintenance and train operation difficult. As a consequence, the [778] invert was concreted to station 121 plus 91, when we attacked the main body of the chert."

Now, in addition to ground swell mentioned in the preceding paragraph and consequent weight, you apparently had experienced a considerable quantity of water at this point?

A. At the time we placed this concrete I believe that the water was less than 10 gallons per minute, practically dry, but we had information from the Hulin report, I believe you will note, that we might expect to find it. I do not know whether it refers to water in the cherts, maybe it does not, but we did expect to find possible gas and oil, and that is the reason for placing this circumferential concrete lining and, of course, at the same time, we would naturally place our inverts; that would give us better operating facilities.

Q. You could not place your concrete lining without placing your inverts, too, could you?

(Testimony of Lewis Michael Larson.)

A. Not a complete one, no.

Q. So that the invert was part of the concrete lining at that point?

A. The procedure we followed was to place the invert first and then pour the lining.

Q. "When excavation was resumed at the last-named Station"—at 121-plus 91, the point where you attacked the main body of the chert—

"we began to feel pressure on our right. We had proceeded about 24 feet when the pressure became so great that relieving sets were erected to support regular four-foot sets. Suddenly water broke out alongside in a quantity of probably 200 gallons per minute, and the pressure was relieved."

Now, in this area which I think you referred to yesterday as being the section of about 120 feet when you emerged from the Chico sandstone going into the cherts you said you had a difficult time.

A. That is my recollection. [779]

Q. You had broken, loose shale, considerable quantities of water running, requiring breastboarding and spiling.

A. Yes.

Q. "At Set 1039 we encountered a large flow in a badly broken chert formation. For a few hours our pumps, having a rated capacity of 800 gallons"—that means 800 gallons per minute, I assume?

A. It does.

(Testimony of Lewis Michael Larson.)

Q. "—could not handle it. Th's reduced in quantity to 580 gallons within seven hours, when the reduction apparently ceased. It was necessary to drive spiling and erect breastboards from this set to set 1052."

That would be from set 1039 to 1052, and at 4 feet apart how far would that be?

Mr. Smith: Were they at 4 or 6-foot centers?

A. I am not sure whether they were 4 or 6.

Mr. Tinning: Q. You said in the preceding paragraph you were setting them at 4 feet.

A. I did in that section, but I am not sure it was here, but even assuming it was 4 feet, 39 from 52 would be about 13, would it not?

Q. And four times 13?

A. It would be 52.

Q. 52 feet? A. Yes.

Q. So that if that was 4-foot centers it would be 52 feet.

Mr. Smith: It depends on the centers.

Mr. Tinning: The preceding paragraph, in talking about the same section— I am trying to see what we can get there in definite form in this matter as to this section, because, as you state at the beginning of your letter, it makes it somewhat difficult to tie in with stations.

A. I think possibly to make it clear I should say that most of the spacing of the sets was 6 feet, that was general.

(Testimony of Chad F. Calhoun.)

Q. But your letter says in going through this section you placed them in four-foot centers.

A. Yes.

Q. After you got into the cherts.

A. Yes. I might not have [780] carried it through the faulted section at 4 feet, I am not clear on that.

Q. You also in this faulted zone had to place relieving sets. "At Set 1039 we encountered a large flow in a badly broken chert formation." You remember Mr. Hulin's report where he said you might expect water in the lava. "For a few hours our pumps, having a rated capacity of 800 gallons, could not handle it. This reduced in quantity to 580 gallons within seven hours, when the reduction apparently ceased. It was necessary to drive spiling and erect breastboards from this set to set 1052, when the chert showed a tendency to stiffen.

"Blasting was permissible then to set 1054." Now, when you were coming up to set 1052 wasn't blasting necessary?

A. I would imagine not, from the fact that I do not mention it.

Q. Wouldn't it also be, where you were spiling, you would have such loose material that you had to place relieving sets that you might not require blasting?

A. That would be my conclusion.

Q. In other words, you could pull this stuff out from behind the breastboards and it would run out like loose gravel or loose rock?

(Testimony of Lewis Michael Larson.)

A. With the water contents I think that would be true. I think we drove spiling in that area.

Q. Doesn't the letter say you drove spiling?

A. Yes.

Q. In the preceding paragraph I just read?

A. We drove the spiling and breastboarding.

Q. And you had running material?

A. Which would indicate we did not use powder.

Q. Then we come back to the letter,

"Blasting was permissible then to set 1054, when we again encountered water and badly broken chert, forcing us to again resort to spile driving and breastboarding. At set 1064 we again reached firmer ground, which permitted [781] blasting, until set 1065 was reached,"—that is one set—"when a further addition of water and bad ground forced spile driving again. At set 1069 we appeared to have found better going, though we had later on to erect spiling before blasting the lower part of the face. This condition prevailed until the point of set 1085 was reached. From there on until the chert was passed the ground progressively stiffened, and some heavy blasting was necessary to break the vertical chert. Timbering was spaced up to a distance of 12 feet between sets, where ground was standing well. At sets 1136 to 1139 we later had to erect two relieving sets. Generally speaking, this vertical chert did not take weight after we passed through it."

(Testimony of Lewis Michael Larson.)

Isn't it a fact that through about the first half of the chert area of 1,000 feet that you had variable material, you had about 120 feet when you passed through the fault, where you had to use breast-boarding, spiling, and you had flowing water in that first 120 feet practically throughout all of it?

A. I would have to check up on station numbers to give you a definite reply to that, Mr. Tinning. I think the important point, though, in this is to state that in spite of all these apparent difficulties the cost of the job was below my estimate, and that estimate was based on the geological report and specifications.

Mr. Tinning: We will ask that that go out as not responsive.

The Court: It may go out.

Mr. Tinning: Mr. Larson, I am interested in the condition that you actually found there and I will give you some of the station numbers and ask you if you can remember from these construction records or by notes which you have as to what was actually encountered in that chert? Now, this tunnel that you were making was not very much larger than one of the wall plate drifts of the [782] Broadway Low Level Tunnel, was it?

A. It was about 12 by 12, not much larger than that lower drift.

Q. About that size, and you had timbers in there, 12 by 12 timbers, did you not?

(Testimony of Lewis Michael Larson.)

A. In the Claremont, I did in the Broadway Tunnel.

Q. I did not ask you what you had in the Broadway Tunnel, I asked you, Mr. Larson, what timbers you had in the Claremont Tunnel.

A. 8 by 12.

Q. 8 by 12? A. Yes.

Q. And some 8 by 12 timbers were shattered and crushed at various places in this tunnel and as you passed through the broken portions of the various formations?

A. Yes, in some cases.

Q. In a 12-foot excavation? A. That is true.

Q. Do you remember, Mr. Larson, that at Station 120 plus 63, which was in the Chico sandstone, just before you entered the fault, a cave occurred in a material that was a mixture of sandstone and rotten cherts which required the excavation to be shut down and new pumps installed, and you there had to breastboard the surface of the tunnel as you drove into this rotted and shattered cherts?

A. I believe that is a mistake. ✓

Q. You think that is a mistake?

A. I think that is. I think you will find you are reciting a condition at about station 86.

Q. You think that that is a mistake in the record?

A. I think that is a mistake.

(Testimony of Lewis Michael Larson.)

Q. We won't pursue it further if you think it is a mistake. Now, we are coming eastward from station 120 plus 53 to 119 plus 86. The District record shows that cherts was badly shattered, with occasional layers of sandstone, much water, heavy timbering was required, and that the timbers were set back 12 inches so that you got a much heavier lining, as the specifications permitted the [783] District Engineer to order. Now, this was in the fault area.

A. We are getting mixed. That was still following up on this enlarged section, and in an area that was possibly two or at least 1,000 feet away from there.

Q. You remember that you passed into the cherts, according to your own letter, at 121 plus 92?

A. Yes.

The Court: What is the distance across that cherts formation?

Mr. Tinning: About 1000 feet. Now, 121 plus 92 is out here. A. Out here.

Q. Now, I am talking to you about a station further east than that, 120 plus 63. You said you thought I was mixed up. What did you mean?

A. I am very confident you are. I think you are talking about the thing that occurred about station 86.

Q. I am coming to station 86 later on.

A. I have no recollection of what you are mentioning here.

(Testimony of Lewis Michael Larson.)

Q. Station 86 was in the Orindan?

A. Station 86 would be where we ran from the Orindan into the lava.

Q. Yes. I will come to that later on.

A. But I have no recollection—

Q. You have no recollection of the requirement of widening or thickening the concrete in the very place that you installed this concrete before you passed into the cherts?

A. I can feel perfectly safe in saying it is a mistake.

Q. It is a mistake? A. Yes.

Q. Would you say that from station 120 plus 63 to 119 plus 86 the cherts was not badly shattered?

A. 120 plus 63 to 119 plus 86.

The Court: Keep in mind you are reading from the report there.

Mr. Tinning: No, I am not. I am reading from a document which he said was a report of the East Bay Municipal Utilities. [784]

The Court: I just wanted to have the witness know; I was mistaken; I didn't know whether it was or not. I wanted to clear it up.

Mr. Tinning: I am sorry I did not make it clear. I am referring to some construction records of which I have notes and asking him from his recollection.

A. I think that was in the fault zone; I take it so from the information that has been given by my letter to Dr. Louderback, that the fault zone was

(Testimony of Lewis Michael Larson.)

farther west than indicated in the Hulin report, and now you are speaking of the fault zone, and I think that was pretty well crushed.

Q. I did not make it clear in my question so that you know what area we are in. That is the area of heavy timbering and it was a fact that the timber was set back so that there was a 12-inch extra thickness of lining placed there.

A. That I don't recall.

Q. You don't recall?

A. I don't recall that.

Q. You would not say that that had not been done? You have in mind the place of great difficulty around Station 84 where you did have to put in a 24-inch lining. Is that the only place you thickened the lining?

A. No, there was another place where we ran into 40 feet of heavy swelling ground and it might be that this was the particular distance, but I had in mind a location that was different, we had to set the timbers back in that we had to put in relieving crews—just to illustrate, to make it clear, I had been told that in the San Pablo Tunnel that same material effectually closed and absolutely closed the tunnel three times. In this particular place I put in what we term full circle sets—I think that is what you are referring to—but the timbers there protected, on account of the swelling of the ground, and I put on relieving crews, that is to keep digging the [785] ground back away from the timber to prevent the breakage, and then later on enlarged the

(Testimony of Lewis Michael Larson.)

section, and the swelling was so rapid that I had to pour the concrete in smaller sections there.

Q. 6-foot sections placed by hand?

A. Something like that, yes, and pour the caves, as it would have the effect of shutting off the air and taking up the compression before it raised itself against the pressure placed concrete, and that probably is the section we are talking about now. We did encounter one there now of 40 feet, as I recall it.

Q. Don't you remember that that section that you just referred to so graphically was over 84?

A. I do not recall it.

Q. In the Orindan? A. In the Orindan.

Q. Where you had water in the Orindan?

A. I would be reasonably sure to say no, not in the Orindan.

Q. Not in the Orindan?

A. I am very sure my memory is correct on that. You see, we are now in the Chico sandstone, just leaving the Chico sandstone, and we have not run into the Orindan yet.

The Court: We will take a recess now until two o'clock.

(A recess was here taken until two o'clock p. m.) [786]

(Testimony of Lewis Michael Larson.)

Afternoon Session,

Wednesday, April 20, 1938;

2 O'Clock P. M.

LEWIS MICHAEL LARSON

Cross Examination (Continued)

Mr. Tinning: Q. Mr. Larson, I understood you to say, just before the noon recess, that the majority of the timbers used in the Claremont Tunnel was 10 by 12 in the cross-section? A. 8 by 12.

Q. 8 by 12? A. Yes.

Q. And, to pursue that further: In some places where you had heavy ground, did you use heavier timbers?

A. I believe, in the two portals of the tunnel—not the two portals; but, on one portal of the tunnel, I started in with 12 by 12, and then I went to 10 by 10 for a distance, and then went to 8 by 12.

Q. Through the Chico and Franciscan, as you went in from the west?

A. I think most of the Chico, I believe was 8 by 12. The Franciscan was 10 by 10,—most of it; and the cherts and the Orindan, 8 by 12.

Q. And the lava? A. 8 by 12.

Q. In these places of heavy pressure that we have been discussing, did you use 12 by 12?

A. Not that I recall.

Q. So far as you know, there were no 12 by 12 timbers in there?

(Testimony of Lewis Michael Larson.)

A. So far as I remember, there was none.

Q. Have you still the copy of your letter to Dr. Louderback? A. Yes, sir.

Q. We have concluded reading to the bottom of page 2 of that letter, and we had diverged to a discussion of some of the stations where there were some pressures and heavy ground, and the difficulties encountered. Coming back to the letter:

“Very little oil was found in the chert, and such as was observed was more apparent in the slippery sand following the water, [787] which generally showed in the broken formation as we approached nearer the firmer chert.”

Now, isn't it a fact, Mr. Larson, that in the first 500 or 550 feet of the chert which you encountered, as you drove from the west toward the east, that, on numerous occasions, you encountered running ground?

A. I have not any direct recollection of that, Mr. Tinning.

The Court: What do you mean by “running ground”?

Mr. Tinning: By that, I mean ground that required breastboarding.

The Court: Very well.

Mr. Tinning: And broken small particles of crushed chert or shale.

A. It is my recollection that those portions, such as there were, were interspersed between firmer chert parts.

(Testimony of Lewis Michael Larson.)

Q. I did not mean to indicate that, throughout the 550 feet, you drove through broken material.

A. No.

Q. As I understand your testimony, approximately 120 feet of the distance after you entered the chert was in broken material; you had considerable difficulty for that 120 feet, and then, I suppose, there may have been some strata that were firmer and not broken?

A. Yes. Those were the things that registered on my memory.

Q. But after you left that 120 feet that you described here yesterday, and came back in the remaining distance of approximately 380 or 400 feet further east from the first 120 feet, you did have interspersed between the firmer layers of chert, the solid, brittle, hard cherts, that area where you had running ground and considerable water?

A. I believe the "considerable water" would be an exaggeration. I don't recall that we struck any considerable amount of water after we left the major formation. Whether there was running [788] material—I would have to refresh my mind entirely, from the letter. It has not been sufficiently registered on my memory that I retained it, because it seems to me that we got through that part and our troubles were fairly easy in the chert section.

Q. The reference that was made, on the preceding page, to sets does not assist you, to refresh your memory?

(Testimony of Lewis Michael Larson.)

A. I would have to check up the spacing of sets, in order for it to be of any value. If you have about 4 feet in the background, it is different than if you had 6 feet, naturally.

Q. Whether it was 4 or 6, it is your recollection, is it not, that, through the first half of that chert, you frequently ran upon lenses or fissures in the solid material in which you found running, broken ground?

A. I would have to reread it more particularly in detail, in order to answer you the question as you have given it to me. I am inclined to think there was probably less; that is the impression that was created: would have probably been less rather than as great—

Q. Well, my question is a general question: That the texture of the material was varying in the first half of that chert? A. It may have been.

Q. Now, we will go over to page 3; and we have read the first paragraph. You state:

"Leaving the chert, we entered the Orindan, which was very firm and hard to break, as was the cemented gravel that frequently appeared. These materials gradually grew softer as we left the chert behind and approached the lava. Most of the oil and oil-gas we encountered was found on the contact of the Orindan with the cemented gravel. As we approached nearer the lava, the gas decreased and the gravel increased, with water dripping in increasing amount. The

(Testimony of Lewis Michael Larson.)

Orindan section generally stood well under 6-foot timber spacing, but broke blocky and did not muck well. One muckerman expressed it [789] that 'it was like mucking wool!'

Q. What did you mean by that?

A. I think it had recementing qualities in it that, when it came in contact with water, the tendency to cement itself into a firmer texture would be present. I think the expression that he used,—the muckerman's expression—the mucker operator expressed it as "mucking wool"—that was his expression.

Q. Do you mean it was resilient?

A. Well, it would tend to fall and break harder in the firmer condition than when it first fell.

Q. "When it was apparent we were approaching near to the lavas and water began to show evidence of decided increase, we discontinued excavation long enough to bring our concrete invert to the then face."

I suppose that that portion of your letter refers to what you stated earlier: that you put in the invert to carry the water to prevent having wet ground upon which you had to lay your tracks?

A. That was the uniform procedure.

Q. I assume, when you came to the contact between the two formations,—the Orindan and the lava,—that you again encountered considerable quantities of water?

(Testimony of Lewis Michael Larson.)

A. Well, my recollection is: Hulin's report stated we would; and I prepared to meet that condition.

Q. I am referring to the geological map here, in back of the Hulin report: Mr. Larson, the Orindan you described in the paragraph of the letter which has just been read, was the Orindan which is shown on this map,—this geology map attached to Defendant's Exhibit "D",—as the aerial line immediately east of the chert, commencing at Station 108, as shown on this map, and running over to approximately Station 88?

A. That is true. That is the part I had in mind.

Q. What you call "lava"—will you tell me what you call "lava," [790] where you see it on this map?

A. Yes. It is indicated by this line, where the broken—the dotted lines end; and we have a solid line.

Q. There is a distance there of approximately 100 feet?

A. Yes.

Q. Shown on this map, longitudinally?

A. Yes.

Q. I was led to believe, from looking at the legend below, that that might be a limestone there.

A. I rather think it was; and I mounted drifters,—they are heavier air drilling machines.

Q. You used those, in passing through this area of limestone which lay immediately to the east of the first strata of Orindan which you encountered?

A. That is true.

(Testimony of Lewis Michael Larson.)

Q. What is the next material that you encountered which seems to be coming off to apex or peak just east of the limestone?

A. The interpretation I received at that time was that that was a volcanic ash. That is where we encountered the major portion of our water in the lava formation. We drove into that in the shot,—the last shot where we used a drifter, which enlarged that hole by about one foot; and the pressure of water and the material broke open the face progressively.

Q. You mean it opened it up?

A. Yes; it broke through the formation,—created hydrostatic pressure and broke through.

Q. Broke through the last part of the limestone that was in the face—— A. Yes.

Q. After you passed through what you call “volcanic ash,” what material——

A. Then we ran into the real lava, as indicated by the Hulin report. That continued up to the Pinole Fault.

Q. On this map, doesn't the legend indicate what you call the “volcanic ash” is a conglomerate Moraga formation?

A. That is what is noted on the map. I received the interpretation,—whether it was from Dr. Louderback or other sources,—that it was really a [791] volcanic ash. Whether that interpretation was correct, I never ascertained.

Q. In this tunnel, at some point you had a place where there was 50 or 60 feet of limestone between the volcanic ash?

(Testimony of Lewis Michael Larson.)

A. That is this point we are discussing now.

Q. That is the point where you passed around Station 187? A. No; Station 87.

Q. Station 87?

A. As indicated on this map.

Q. Then you passed through the lava, and you again passed through what is designated here as "conglomerate Moraga formation," and which you say you considered was volcanic ash?

A. I did. Referring to the volcanic ash on that end, I find that to be the result of a pulverizing of this vertical uplift of the east end of the Pinole Fault,—that section that formed the fault. That was my conclusion.

Q. Then you drove beyond the Pinole Fault,—what you call the Pinole Fault; so designated on this map. You were back into the limestone and through that, into the Orindan, again?

A. The limestone, I don't remember. It was probably in the pulverized section. I don't remember driving the same formation on leaving the lava as I did on entering. The line of demarcation between what I believed then to be the lava and the Orindan was very marked.

Q. It came out of it sharply?

A. Very sharply.

Q. Within how many feet, would you say?

A. I think, on a cross-section from the east side to the west side of the tunnel, it would not vary, I

(Testimony of Lewis Michael Larson.)

believe, more than 2 feet. That is my recollection now; but the line was very, very clear.

Q. An abrupt transition from one end to the other? A. Yes. [792]

Q. "On resuming mining, our second shot brought us into the lava. The contact was reasonably soft, but the ground stiffened to such an extent that we found it advisable to discontinue the use of jack hammers and proceed with Leyners. The ground drilled well and broke well, and, though containing some water, gave promise of continuing Leyner ground. At station about 89 plus 00 one of the shots in the right breast penetrated a volcanic ash deposit lying in a sufficiently loose state with a large amount of water, that within three hours the face had broken in against our efforts to hold it and the ash, accompanied with a flow of 1400 gallons of water per minute, partly filled the tunnel for a distance of 60 feet before a sufficient bulkhead to hold it could be erected. The pressure exerted longitudinally forced collar braces from 1½ inches to complete penetration of some of the 8 by 12 timbers. The ash surrounded the sets so that none of them were completely knocked down.

"We dropped back to station 94 plus 08 to 94 plus 40"—

(Testimony of Lewis Michael Larson.)

What do you mean by that, Mr. Larson, do you mean that you receded by reason of the intrusion of the ash in the tunnel?

A. The amount of water was so great that it seemed to be an economical procedure to delay trying to force an entrance in through this volcanic ash area until the water in volume receded, and it was at that period of stopping that I dropped back to put this concrete in that we are now coming to, because it was, in my mind, an economical and proper procedure.

Q. This station at 94 plus 08 was in the Orindan, was it not?

A. Apparently it was.

Q. And it was how far east of the point where you had encountered this hard rock—just refer to your letter again, you said at 89 plus 00 one of the shots in the right breast penetrated a volcanic ash, and water came in with the ash—that would be 500 feet west, would it not, 89 plus 0—that would be 500 feet back into the Orindan?

A. Yes.

Q. "Where we had encountered a very heavy swelling ground and had found full circle sets at two-foot spacing, constantly relieved, not holding the ground, and concreted this section"—you had encountered that same condition driving through the Orindan some hundred feet before you came to this contact between the Orindan and the limestone or lava, whichever you wish to call it?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. And during the time that you were driving forward you had noticed this swelling ground?

A. That is true.

Q. And in that area you had to place full circle timbers?

A. I did all that.

Q. To hold the ground?

A. Yes, I thought I would hold the ground that way.

Q. Was that the place where you had to put in straw?

A. Yes.

Q. That is where the ground came squeezing out like dough, like putty, into the section from the bottom, and sides, and every direction?

A. That is correct.

Q. That was in the Orindan?

A. That was in the Orindan.

Q. You concreted this section while waiting stability of the volcanic ash—that is the next portion of the paragraph, so that the concrete lining was 24 inches thick instead of 12?

A. I think it was of that thickness.

Q. And that lining was installed because of the heavy pressure found in the ground at that point in the Orindan?

A. It was.

Q. And finishing that sentence: "hoping in the meantime that water pressure would reduce." I suppose the quantity refers to the water pressure?

A. Yes.

Q. Or the quantity of water?

A. Yes. [794]

(Testimony of Lewis Michael Larson.)

Q. "The quantity dropped to 900 gallons, and it appeared that it might be cut off from the main tunnel by a short drift to our right, which then appeared the direction of the supply. This drift materially relieved the pressure at the face for a few feet, and allowed us to excavate the ash to our former face without much difficulty."

In other words, the flow of water was so great that you drove off to one side of the tunnel a drift to intercept the flow and divert it from the face?

A. That seemed the economical thing to do first, to drift and take the water through that adit, as you term it.

Q. Both economical, and it also was of assistance in proceeding with the driving through this ash, was it not?

A. That is true.

Q. "However, when we erected our breastboards and began to press forward we found the main water supply was coming from a point forward and apparently in the line of bore. As we drove our spiling, each one a couple of inches, until a penetration of six to eight feet was accomplished, we attempted to open a small hole in the breastboard at the last set and advance a new one four feet ahead."

As I understand you, you had at the base of the tunnel a breastboard or bulkhead the ends of which

(Testimony of Lewis Michael Larson.)

were supported against the last set, timber set that you had in there, either against the last timber set or against the stulls in back of some other set?

A. I do not recall that, but it was a solid breastboard.

Q. And made as near watertight as you could get it? A. Yes.

Q. And when you tried to open a small hole in the breastboard, I suppose you worked through that and removed some of the material behind it and advanced a new breastboard four feet ahead, and you found great difficulty in doing that?

A. That is true.

Q. "This often took hours as the runs of fine ash with an ever-increasing quantity of water made it almost impossible to make [795] the slightest opening in our former breastboarding. We gradually advanced a small board on the end of a stull to a point four feet distant. This was our most difficult feat and the new breastboard, however small, would aid in stiffening the new face. The next board, also advanced at the end of the stull, was then placed, after many attempts, each stull being nailed to the cap of the last set."

You mean by that that you had a bar or a beam that ran back to the top of the timber ring, pressing against the stull which had been put in and pressing against the breastboard which had been advanced through a hole in the breastboard?

(Testimony of Lewis Michael Larson.)

A. Yes.

Q. It took many attempts to accomplish this?

A. Yes.

Q. "When two feet of new breast was well boarded"—and by two feet I assume you mean up?

A. From the cap downward.

Q. From the cap down? A. Yes.

Q. "The new breastboards were put in at an elevation lower than the old breastboard four feet back so that the fine material could not flow out during the placing of the new board."

A. Let me correct a statement there. I said from the cap downward. We had driven our spiling in advance and there was no cap. It was from the spiling downward.

Q. In the driving of the spiling you said a few lines back, two inches at a time. Does that mean that you were able to advance two inches at a time, or that it was two inches broad?

A. No, as I recall it this spiling, we would drive this one two inches and this one two inches, and so on all around the arch ring.

Q. And it also included the sides of the tunnel?

A. Yes.

Q. So that you had a barrel-like structure of spiling? A. That is correct.

Q. And made it as tight as you were able to get it? A. Yes.

Q. "During all of this time we had run after run of fine material, [796] that it took all

(Testimony of Lewis Michael Larson.)

our efforts to check, though the total losses were never enough to cause much of a void overhead, or permit a sudden drop of material. When the new breastboard was completed two feet down, one or the other of us would creep over the old breastboard and place the next lower new board. This sometimes resulted in hasty retreats and near strangulation as the runs and water attempted to engulf its intended victim; and on at least one occasion emergency pull by the remainder of the men present saved burial."

In other words, you were working in a soft, wet, loose muddy material at that time, were you?

A. That is true.

Q. And a man had to advance through this hole, in what had been the original breastboard at the face and try to work the breastboard in four feet ahead in that material?

A. The reason for that was that you had to carry your forward breastboard at a lower elevation than the one that was behind it; if you did not the material would swell out and run over.

Q. And run over the top? A. Yes.

Q. You had one wall coming down from the top in the advance breast wall, and you had one coming up from the bottom in the old one?

A. That was a wall coming up from the bottom that had already been placed, that was in place, and we were removing it.

(Testimony of Lewis Michael Larson.)

Q. That was the original breastboard?

A. Yes.

Q. You started taking that off from the top and placing the forward breastboard in from the top and came down with the new breastboard at the plank behind on the old breastboard?

A. That is right.

Q. So that was always higher and formed an edge of the trough that held the muck behind that?

A. Yes.

Q. "After getting through this ash deposit holes were made in the overhead spiling sufficiently large to loosen and cause to run such [797] overlying fine material as was necessary to bring large boulders that showed evidence of being there, down on the top of the spiling to forestall a possible future run and drop of material that might cause a collapse of the timbering and resultant trapping and drowning of the crew. These boulders now rest on the timbering and act as a reinforcement against a drop of others.

"We encountered and ever-increasing quantity of water until 3920 gallons per minute were measured on the weir. As we proceeded we encountered new flows and the area left behind gradually and fairly rapidly decreased."

I do not understand what you mean by the last portion of the sentence.

(Testimony of Lewis Michael Larson.)

A. As we picked up new water the water behind us lessened, although it increased in flow, if it had not decreased behind us then that would have been added all the time to the amount flowing out.

Q. In other words, if you went ahead and kept digging out the water decreased as it flowed out of there and drained that area above?

A. Yes, it lessened behind us as we proceeded to pick up new quantities in front.

Q. So that your maximum quantity of water as you estimated yesterday of 4000 gallons a minute was probably never exceeded?

A. No, I think that was the maximum record on the weir.

Q. "Spile driving and breastboarding were again necessary in broken formations carrying large quantities of water at set 1612 to set 1606, stations 82 plus 92 to 82 plus 82, 82 plus 06 to 81 plus 8175, 80 plus 14 to 79 plus 84, 78 plus 06 to 77 plus 79, 76 plus 28 to 76 plus 01, 74 plus 98 to 74 plus 55, 75 plus 52 to 75 plus 27, 73 plus 25 to 72 plus 74, though at no other point than the one in the vicinity of station 89 plus 00 did we have runs that we found it difficult to control." [798]

Where would the last one of those stations, 72 plus 74, bring us on Mr. Hulin's map?

A. That will still leave us in the lava.

Q. So your troubles that are recited in this para-

(Testimony of Lewis Michael Larson.)

graph all have to do with the problems encountered and conditions and materials met in the lava?

A. That is correct.

Q. "In some of the latter breastboard places we could advance our spiling with coal picks and moils." You mean by "coal picks" that you could drive them in with a sledge hammer?

A. No, by a coal pick, that is a pneumatic pick on which you apply air. Themoil is a point that you drive in with a pneumatic hammer.

Q. How was the spiling advanced in the Orinda where you had so much trouble with it?

A. In the Orinda?

Q. Yes, you drove it two inches at a time.

A. That was in the lava, that was in this volcanic ash section. There we used a ram.

Q. Such as you show here in the picture?

A. Yes, suspended by a rope.

Q. "In some of the latter breast board places we could advance our spiling with coal picks and moils, and breast board as we pulled the muck away from the face. At other times we could breast board half way down the face and lightly shoot the toe to make mucking easier.

"In cases where we found enough clay present, the star steel was difficult to free, we found augers worked better."

Star steel is drill steel?

A. It is what is termed a star bit.

(Testimony of Lewis Michael Larson.)

Q. "Track laying under twelve to eighteen inches of water, we found difficult, and all timber and lagging and collar braces had to be tied down to prevent them from floating away and derailing trains. Wedges were a constant menace as their size made them hard to hold and easy to float. When we re-entered the Orindan, we found it reasonably soft and blocky. Very little water and no [799] gas penetrated it."

Did you consider the ground through which the Claremont Tunnel was driven self-supporting?

A. Some of it, yes.

Q. Which portion?

A. A good portion of the cherts I would consider self-supporting. However, I wish to qualify that by saying that when we were driving through it and I did not know the nature of the cherts I thought it was necessary to put these sets that I have mentioned with 12-foot centers, but later on I took them out and adopted 24-foot centers as a protection against fragments falling on the workmen.

Q. Did you lag or crown-bar between the sides?

A. No. I lagged over that portion that would come over the track where men would be working.

Q. In other words, you had a roof of crown bars or lagging above the 12-foot sets that you have referred to?

A. Yes, I had lagging above that.

Q. The total excavation in the Claremont Tunnel section was about 12 feet high and 12 feet wide?

A. Approximately.

(Testimony of Lewis Michael Larson.)

Q. And in the drift, wall plate drift that you proposed to construct in the Boardway Low Level Tunnel, what was the size?

A. I think at the bottom probably 10 feet. That is something I have not checked up on lately, running to possibly 3 feet at the top. You see, the wall plate drift slopes in with the arch and at the top would be considerably less in extent than it would be at the bottom.

Q. And the timber used in the Claremont Tunnel was 8 by 12? A. Generally.

Q. Generally? A. Yes.

Q. And in the wall plate drift the timber that you used, that you drove the Broadway Tunnel through, was what size?

A. In the drift, [800] itself, it varied, I think from 8 by 8 to 10 by 10, but when I widened out my wall plate and put in the permanent sets, the wall plates were 14 by 14 and the set timbers were 12 by 12.

Q. Mr. Larson, I was directing my question to the timber you used in driving the wall plate drift before you proceeded with any other part of your work.

A. That was mainly 8 by 10, 10 by 10.

Q. When you returned to the Boardway Low Level Tunnel in August, 1935, you inspected the drift that ran from the east portal—there were three drifts, I think, completely driven through at that time? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. What was the size of those wall plate drifts?

A. I think they were about 10 feet high, that is my recollection now, and at the bottom probably 10 feet wide, and at the top at least four, between four and five feet wide. That is as near as I can recall it now.

Q. What size timbers were used, did you say, in these drifts?

A. I used some 8 by 8, some 10 by 10; I do not recall that there were any 12 by 12.

Q. How far apart were the timbers placed in the wall plate drift that you used in driving the Broadway Tunnel?

A. Was that in the first excavation, or after I put my wall plates in?

Q. The first excavation.

A. In the first excavation I aimed where possible and in most cases did succeed in going a distance of six feet.

Q. Where you put your wall plate later, the place that you referred to in your question to me how far apart?

A. My recollection is that in general the station was 3 foot centers, though in some cases where I anticipated a possible weight I put them closer. I did not use any uniform spacing standard. I tried to meet what was necessary and what would become necessary. There were some cases there where I believe I [801] put in two together and then spaced the next one either two or three feet and put two or

(Testimony of Lewis Michael Larson.)

three more; there was no regularity; as I said, it was entirely in my judgment of what pressures we would have to meet.

Q. What was your reason for placing the timbers in the wall plate drift that you have just been referring to on three-foot centers when previously you had been placing them on six-foot centers?

A. In the first place, the drift was temporary and was smaller in opening than the wall plate in its enlarged section; further, it controls only with one operation, that is, it is supposed to hold the ground on the core to the height of the wall plate drift and the material above it to whatever that may be, which is probably somewhere between 3 to 4 feet, and on the permanent timbers you have to meet that with sufficiently strong supports that extend from one wall plate to the wall plate on the other side, that is, you have to cover several drifts.

Q. Wasn't the reason that you brought your timbers closer together the fact that the drift was a bigger drift than the one where you had them 6 feet apart?

A. No, the primary reason was I would have several drifts tied together to form the ring of the arch, and would not have to confine the strength merely to a small drift, but it would have to be able to transmit the weight of the whole thing onto the timbers.

Q. So that the closer spacing of the timbers was to take care of that weight and also to take care of

(Testimony of Lewis Michael Larson.)

the fact that it had a bigger opening than it had where the drift had the timbers 6 feet apart?

A. That is true.

Q. It was not due to the fact that it was in different ground?

A. The spacing of the timbers and the size of the wall plate was conditioned on the ground. [802]

Q. I am not talking about the timbers now. We are talking about what I might call your temporary drift timbers.

A. No, the temporary drift it appeared, and in most cases I believe it proved that on the 6-foot stations with the timbers that I have mentioned they were ample.

Q. When you inspected the old tunnel and you described the result of your inspection to us you told us that you considered the formation of the cherts disclosed there.

Mr. Smith: Does that question refer to the old highway tunnel?

Mr. Tinning: Yes. There is no mistake in your mind about that, is there, Mr. Larson? A. No.

Q. I am referring to the old tunnel which you said you visited and passed through when you inspected the site early in March, and you saw cherts standing in that tunnel. You subsequently formed an opinion because that material was higher in that formation than the Boardway Low Level Tunnel, that it would not be as good material as you had in the tunnel, and that you could anticipate in the tun-

(Testimony of Lewis Michael Larson.)

nel, because the deeper the material the better the formation.

A. That has been my experience. I based it on observations in my past experience.

Q. The old tunnel stands at an elevation of approximately 1030 feet and the Broadway Tunnel at an average elevation of approximately 800 feet?

A. That is the sub-grade of the tunnel, I presume.

Q. Well, the point is I am trying to get a comparison between the two elevations, one tunnel is, the Broadway Tunnel is about 250 feet lower than the old highway tunnel? A. Yes. [803]

Mr. Tinning: Q. The Claremont Tunnel, you will recall, has an elevation in the neighborhood of 300 feet?

A. Yes; 321, I believe, at the top.

Q. So, the Claremont Tunnel is approximately 500 feet lower in elevation than the Broadway Tunnel; and approximately 700 feet lower than the Old Highway Tunnel?

A. I believe that is approximately correct.

Q. From your experience in driving the Claremont Tunnel, would you say that the cherts that you encountered there were better than those that you saw in the Old Tunnel?

A. I think that they were; the laminations were closer, and the material would stand at a greater span; that is, they supported an open structure better in the Claremont Tunnel.

(Testimony of Lewis Michael Larson.)

Q. Then, if I understand your answer, it is your opinion, from driving that tunnel, that the material was better in the Claremont Tunnel,—the cherts better, had more sustaining power,—than in the Old Highway Tunnel?

A. I thought the laminations were closer.

Q. Would you answer my question?

A. I thought they were slightly stronger, yes.

Q. You thought they were stronger?

A. Yes.

Q. How about the Broadway Tunnel?

A. May I ask just what you mean by the question?

Q. Were the cherts in the Broadway Tunnel better than those in the Claremont Tunnel?

A. I know nothing of the cherts in the Broadway Tunnel; I did not see any of them.

Q. Did not see them?

A. No; unless those were chert sections that we ran through. They may have been shale sections; those that I have enumerated on my experience in the tunnel. My reason for saying that is that Dr. Louderback told me they were not cherts but shale. I had previously enumerated, in my notes, that they were [804] cherts.

Q. From your experience in the Claremont Tunnel, would you say that the Orinda formation which you found in the Claremont Tunnel, at an elevation of approximately 500 feet lower than the elevation of the Broadway Tunnel, was better,—

(Testimony of Lewis Michael Larson.)

stronger material,—than the Orindan encountered in the Broadway Tunnel?

A. I hadn't arrived at the conclusion; the reason for that being this was a different type of deposit. It was a deposit either of flood waters, apparently, or a deposit of material in the lake formation. My experience was new on the Orindan, and I could not conceive of what might be the result of the difference in depth of this material.

Q. When you inspected the Boardway Tunnel in August of 1935, and you passed through those drifts that were driven from the east portal through the Orindan formation, did you form any opinion as to the characteristics of that Orindan as compared with the Orindan that you encountered in driving the Claremont Tunnel?

A. I thought that they were less firm; that was my conclusion, looking at it after the drift had been opened for a period of time.

Q. That was the reason you did not form an opinion: you knew the drifts had been opened for some time?

A. I knew they had been, and I was not in a position to know what the weathering effect might have been, and I was not in a position to draw an accurate conclusion.

Q. When you passed through those drifts in August of 1935, did you notice any of the timbers, that were supporting those drifts, showing strain or stresses?

(Testimony of Lewis Michael Larson.)

A. I saw a few where blocks of material had lodged against them, where the timbers had to have reinforcing, by either stulls or sets placed adjacent to the other set.

Q. Did you see any timbers that were broken, forced out of line, [805] except for the blocks of material falling on them?

A. I don't recall, now, that I did.

Q. There was no evidence of heavy pressure in those drifts?

A. There was no evidence of pressure other than that of loosened rocks; that was my conclusion, as I recall it now.

Q. Well, blocks are pieces of material that have dropped out of the roof? A. Yes.

Q. Or the sides? A. Yes.

Q. That is a characteristic of Orindan, is it not?

A. It is a characteristic of Orindan, yes.

Q. You saw no evidence of pressure such as you saw at the point we have been discussing in the Orindan where you had swelling ground in the Claremont?

A. No. I believe, Mr. Tinning, that that portion which we have been discussing in the Orindan was not Orindan; that would be my conclusion. I may be wrong about that; I am not a geologist; but it was an intrusion that was found only at that one point in the total of some 7000 feet of Orindan.

(Testimony of Lewis Michael Larson.)

Q. In other words, the material may have been; it was in what is shown on Dr. Hulin's map as Orindan; that is at Station 94,—the one where you had to put in the double barrel?

A. That was in the Orindan section.

Q. Where you required the double blocks, it was in the Orindan section. You found no condition similar to that condition when you inspected the timbers in the drifts in August, 1935, in the Broadway Tunnel? A. I did not.

Q. Mr. Larson, I am going to refer now, for a time, to Dr. L. nderback's report, Exhibit 22.

Your Honor, it may be of assistance to have this before you; it is a copy of the one that is in evidence, Exhibit No. 22. This is one of my file copies.

[806]

Q. Mr. Larson, if you will look at page 1 of the report,—Plaintiff's Exhibit 22—there is a paragraph I would like to direct your attention to,—“Proposed New Tunnel Road”—because it refers to some general matters.

“The following is a report on the geological conditions along the line of the proposed new low tunnel highway between Alameda and Contra Costa Counties, based on observations made on the ground surface along and in the vicinity of the proposed highway and tunnel line, with the aid of such clearing, cuts and artificial openings as were made up to June 18, 1932, supplemented by laboratory studies of

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(Testimony of Lewis Michael Larson.)

some of the collected material. The proposed line is that indicated on the map entitled: Joint Highway District No. 13, Topography from Broadway to West Portal, Nov. 6, 1930, and corresponding profile dated March, 1931, and on the plan and profile of tunnel dated May, 1932, and in geological cross section dated July 7, 1930."

I call those matters to your attention, because I understood, from your testimony, that you read a copy of a portion of Dr. Louderback's report, pages 13 to 19, dealing with the geology of the tunnel, and that you never saw, as I understand it, the rest of the report?

A. Not at that time that I read the tunnel geology. At the time I read the tunnel geology, I had not seen this; I had not seen this prior to the entering of the bid; that is what your purpose is in the question, I believe.

Q. That is what I have in mind. When you were preparing your bid, and making the assumptions that you have stated you made, you were basing them entirely upon the information which was furnished you by someone in the Six Companies office, —I believe it was Mr. Calhoun who gave you that data?

A. A copy of the geological report.

Q. Yes; a copy of those pages of the geological report?

A. That [807] is correct.

(Testimony of Lewis Michael Larson.)

The Court: Q. So I may follow that testimony: Mr. Calhoun, in the Six Companies' office, gave you portions of Dr. Louderback's report?

A. Yes; the portion between pages 13 and 19, that covered the tunnel geology.

Mr. Tinning: Q. And you had, in addition to the pages that you have just stated you got from Mr. Calhoun, a tracing of the map which was made by him, and which is an exhibit here,—Plaintiff's Exhibit 23—might I have it, Mr. Clerk? Exhibit No. 23, Mr. Larson, if you will look at the last map in the geological report, it is the last document—the map attached to the report which was apparently a tracing taken from that?

A. Apparently, yes.

Q. Now, you also had that map on Exhibit No. 23 before you when you were considering Dr. Louderback's report.

A. Yes, I had.

Q. Those were the only portions of the report which you had in your possession at the time that you prepared your estimate?

A. They were the only portions that I had at that time.

The Court: Is that true of the other report?

Mr. Tinning: Yes, your Honor.

Q. Mr. Larson, I am just trying to clear this up.

The Court: I just wanted to follow the testimony; that is all.

Mr. Tinning: Q. I understood that all you had, Mr. Larson was the pages dealing with the tunnel

(Testimony of Lewis Michael Larson.)

geology; you did not have the first page that refers to the various things in the paragraph I read to you; you had only pages 13 to 19, and the tracing that Mr. Calhoun had made of the last map which is attached to the report? A. That is true.

Q. You had no other part of the geological report made by Professor Louderback, before you, when you arrived at your conclusion [808] respecting the conditions that would be met in the construction of the Broadway Tunnel?

A. That is true.

Q. Will you please open the geological report to the next to the last map that is attached thereto, Mr. Larson? You will notice that that is a map,—a geological map,—dated May, 1932?

A. Correct.

Q. Plan and profile of the Tunnel. The diagram which you looked at, in the preparation of your work, was prepared in July, 1930, by Dr. Louderback? A. Yes.

Q. It so appeared on the report that you had?

A. Yes.

Q. If you will look at the last map appearing in Plaintiff's Exhibit No. 23, the Louderback Report, you will see the map was dated July 7, 1930?

A. Yes.

Q. And that it shows, in addition to the matters that appear on the diagram, or the tracing that was made by Mr. Calhoun, a so-called final location?

A. Yes.

(Testimony of Lewis Michael Larson.)

The Court: "A final location"?

Mr. Tinning: Yes, final location.

Q. That did not appear on the document that you had?

A. No; I believe it did not. I think he gave only——

Q. Well, Exhibit 23 was the tracing of the——

A. Yes, just this portion.

Q. Yes; and did not show the proposed alignment of the tunnel? A. No.

Q. Now, in the extreme left of Exhibit 23, you will notice Mr. Calhoun sketched in something called "Hill Wash and Creep"? A. Yes.

Q. On the sheet dated May, 1932, you will find, at the extreme left of the sheet, "Overburden of Stream Deposit and Hill Wash and Creep"? You will see that that extends from a point considerably west,— [809] over 100 feet—125 feet west of the portal of the tunnel, to a point five or six or seven hundred feet east on the hill slope?

A. To Station, approximately, 115 plus 50.

Q. Yes, from approximately Station 108. Now, that dotted line signifies unknown location, doesn't it; it is a generalization, and simply indicates an unknown deposit?

A. I think that was the intention of Dr. Louderback.

Q. Well, that is what an engineer ordinarily would conclude from that statement?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. When you made your estimate, you had never seen this map, on which it is referred to, on the first page of Dr. Louderback's report?

A. I had never seen this map that you are indicating now. I have not been able to tie it in.

Q. Well, so you can understand the thing, you will see, on the first paragraph on the first page of the report, reference to the plan and profile of tunnel dated May, 1932?

A. And the geological cross section dated July 7, 1930. [810]

Q. Now, referring to the diagram which you had not seen, and reading Dr. Louderback's report commencing page 13:

“West Portal

“The material at the portal as indicated in profile is largely stream wash, hill wash, and creep,—soft, weak and pervious to water.”

The Court: That has reference to the stream deposit?

Mr. Tinning: Yes. (Continues reading):

“In the actual construction much of this will probably be removed entirely by open cut, any that remains will require positive support as it cannot be expected to maintain itself unsupported for any length of time.

“The hill slope from the indicated portal up to near the crossing of the present ‘tunnel road’, carries a considerable covering of hill

(Testimony of Lewis Michael Larson.)

wash and creep material, largely consisting of a fairly loose sandy soil. Its depth cannot be accurately estimated. At about 950' elevation it is about 15 feet thick, and above this towards the present tunnel road it varies from about 10 to 3 feet in thickness. It erodes out very easily under the action of running water and the road culvert has had its outlet position changed at least twice, apparently due to the deep trenches the water has cut.

"Near Station 113, from altitude 860—870 is a bench that appears to be a stream terrace the back part of which carries a thick coating of wash and creep material from the hillside above. It all lies above the level of the tunnel roof but would have a tendency to carry water for awhile after rains and feed it down into the tunnel.

"Monterey (Subrante?) Sandstone.

"The first bedrock formation encountered is of sandstone and [811] sandy shale, probably of the Monterey Group (Sobrante Sandstone?). The sandstones are light gray when fresh, light ochreous colored when weathered. When fresh they are firm, sometimes hard and resistant, but most of the material slacks on exposure to the atmosphere, exfoliates and crumbles down. On weathering it assumes a pale yellowish or ochreous color and mostly disintegrates into

(Testimony of Lewis Michael Larson.)

sand. The sandy shales when fresh are brownish and firm but also slack, exfoliate, and disintegrate on exposure at the surface of the ground. A test tunnel recently run in about 124 feet in the west portal region exposes the fresh sandstones and sandy shales in the face. If this fresh and relatively unbroken condition continues, the formation will prove satisfactory insofar as sufficient height of such material lies above the tunnel roof to give satisfactory support. Where it is but a thin mass between the tunnel roof and the overlying disintegration products it is desirable to plan for its artificial support or removal even if it stands well on first opening.

“Even in the tunnel these rocks will be subject to gradual slackening, although much more slowly than when exposed at the surface of the ground. This should cause but slight difficulty during construction, and when the formation is protected by the finished tunnel lining this action will no longer be effective.

“As at the surface of the ground, only the weathering products are to be observed, before actually driving the tunnel through, the condition of this formation along the tunnel line, and depth to the top of the fresh firm rock, can be determined only by test holes or borings. The condition shown in the face of the tunnel

(Testimony of Lewis Michael Larson.)

are promising of satisfactory conditions beyond.

"On the surface the sandstone ends about at the present 'tunnel road' which probably means that along the proposed tunnel line it [812] would end about Station 118 or $118 + 50$, 175 feet—180 feet underground.

"For statement of oil and gas possibilities see under Claremont Cherts.

"Claremont Cherts.

"After leaving the sandstones the prevailing formation for about 1200-1300 feet, is the Claremont Chert (called Claremont Shales in the San Francisco Folio of the U. S. Geological Survey). This formation consists chiefly of a series of alternations of layers of chert from 2-6 inches or more thick, and somewhat thinner layers of siliceous shale. Occasionally a layer of clay shale, sandstone, siliceous ferruginous limestone, or volcanic ash is encountered.

"Water. The strata of this formation intersect the ground surface at steeply inclined angles, and they are cut by many small faults, which in many cases also intersect the surface. The cherts are quite brittle, and any fractures or crush zones produced in them by earth movements tend to remain open and allow free movement of water. The combination of these characters generally results in water flowage through

(Testimony of Lewis Michael Larson.)

many lines in the formation. Previously stored water may be tapped by the tunnel driving. The Claremont tunnel penetrated this formation at a greater depth, and therefore under conditions likely to develop more water than the proposed tunnel. It also encountered it where affected by marked faulting. Nearly 700 gallons a minute were yielded by the cherts when first penetrated, but this yield has since dropped to less than 50 gallons a minute.

"The old inter-county highway tunnel lies entirely in the chert formation, but at a still higher level than the proposed tunnel. I do not know whether it developed much water during construction. It must have yielded some but probably not very much. At present, [813] after rains, there is a certain amount of drip and seepage into the tunnel, and a similar renewal of water flow after rains would undoubtedly take place in the cherts penetrated by the proposed tunnel, even after all storage water had been drained off.

"Fortunately none of the rock types found in the Monterey chert formation as developed in this area suffers from contact with water. They all stand as well wet as dry.

"Oil and gas. The cherts and most of the shales of the Monterey formation are bituminous, and on being heated to a high temperature yield oil and gas. This property, however, is

(Testimony of Lewis Michael Larson.)

not likely to cause any trouble in the course of tunnel driving. But in the course of the geological history of these rocks, some oil and gas has been developed and may be encountered in tunneling, where formation is moderately dry."

(After recess.)

Mr. Tinning (Continues reading):

"In the Claremont tunnel, presumably largely due to the very free flow of water through the cherts, but little oil and gas was encountered, and no trouble was experienced from this source. It may be added that on account of gas troubles in the Chico formation, the tunnel was worked with strict rules about open lights, matches, and smoking, and this may have had something to do with the lack of gas trouble in the cherts. Some of the oil and gas which undoubtedly originated in the Monterey chert formation, was found in the Orinda formation at and not very far from the contact with the cherts. The oil and gas had apparently penetrated the Orinda formation along small faults and fissures. They caused considerable trouble in the eastern part of the Claremont tunnel, where at one time a heavy blast in the face set fire to the oil and gas which in turn ignited the timbers, entailing much delay and expense.

"In the San Pablo tunnel, where the body of cherts is more [814] closed in by overlying

(Testimony of Lewis Michael Larson.)

rocks than in the proposed tunnel, a serious explosion occurred while they were driving through the cherts.

"It is possible that some oil or gas or both developed from the cherts, may have found its way into the Monterey (?) sandstones, and it would therefore be a measure of safety to drive the tunnel with suitable precautions, especially as the cherts are approached within a few hundred feet. If light oil is struck in any part of the tunnel, it should not be allowed to collect in pools or depressions or stand in drainage ditches as it may gradually develop gas and become liable to ignition or even explosion, setting fire to timbers or causing worse damage. It is impossible to predict the exact location or amount of such material that may be encountered. It may be little or none, or it may be in troublesome amounts. It should be watched for and given immediate attention if encountered.

"Structural Characters. In general the chert belt is rather regular in its structure, the strata dipping high (56° - 80° at the surface) to the southwest.

"The southwest 100 feet or more of the chert is the most irregular part of the belt intersected by the proposed tunnel line (about $118+50$ to $119+50$). It is cut through by a fault of considerable magnitude which is probably a continuation of the Wildcat fault of the San Fran-

(Testimony of Lewis Michael Larson.)

cisco folio. This fault has caused more or less shearing, and displacement along subsidiary fractures with rotation of minor blocks and crushing in certain zones. To the northeast of Station 120+00, the structure appears to be remarkably regular to the northeast limit of the chert belt, although there are present some minor faults and crushed zones.

"The fault zone will be occupied by broken and possibly crushed chert. In the Claremont tunnel, the chief yield of water from the cherts came from this fault zone. [815]

"In driving through the cherts, the combination of crushed zones and water often presents difficulties. The crushed rock (with or without water) may flow out into the tunnel almost like quicksand, or, if it holds together better, it may develop considerable pressure, until the water pressure is relieved by free flow into the tunnel. In the Claremont tunnel the careful driving forward of spiling was necessary in the more broken and the crushed portions of the chert. In certain cases where a broken or crushed mass of rock lies within intersecting fault planes, and thereby loses its bond to surrounding rock, it may slump down into the open working, leaving a chamber in the wall or roof. If this is experienced at all in the proposed tunnel it will probably be in the southwestern fault zone mentioned above. If such un-

(Testimony of Lewis Michael Larson.)

ported blocks or masses are met, it would probably be best to let them down or remove them, before placing the concrete of the completed structure.

“Based on experience gained from other tunnels in the cherts, and judging from long exposed steep quarry faces in the same formation, it may be expected that after driving, and after the material in the immediate vicinity of the tunnel has come to equilibrium, the rock will stand well and need no support. The main belt of the cherts beyond the fault zone has a particularly favorable structure from this standpoint, and is the strongest and most stable material to be penetrated by the tunnel. Even the part in the fault zone is likely to stand well after the driving through it is completed. This was the experience in the Claremont tunnel.

“The Orinda Formation.

“From about Station 130 (as judged by surface dip, but it may be farther along in the tunnel as the dip may steepen underground), to the east portal of the proposed tunnel, the bore will be entirely in the Orinda formation of Pliocene age. This formation consists of [816] a series of alternations of beds of consolidated gravel, clayey sandstone, and sandy clays, which were laid down as fresh water deposits. The beds dip at high angles (50° - 60°) to the south-

(Testimony of Lewis Michael Larson.)

west. Tunnel driving is generally rapid in the sandstones and clays, somewhat slower in the gravels, which are naturally harder on drill steel. The formation usually breaks rather blocky and often develops a certain amount of overbreak.

“Water and Its Effects.” “Water is usually in very slight amount in the Orinda formation, coming in along certain gravels and coarse sands, or seeping along minor faults or shear zones. Most of the formation is likely to be dry. In the tunnels already driven through it, the greater part of the clayey sandstones and clays were dry and dusty.

“While these sandstones and clays are naturally mostly dry, they are generally affected by contact with water. In fact they are sensitive to both drying and wetting, and a chunk removed from underground and exposed above ground usually cracks and slacks in the sun, and breaks down into a soft clay or mud in the rain. While the beds are firm, and when dry stand well underground, they carry but little natural cementing material, except in occasional layers. These cemented layers remain firm even on exposure to sun or water.

“Where not badly sheared this formation is likely to stand well provided it is protected from water action and air slacking. In the Lafayette and Claremont Tunnels where water (a com-

(Testimony of Lewis Michael Larson.)

paratively small amount) came down through sheared clays or clayey sands, a locally weak zone was produced that made weight on the timbers, or slowly pushed them in laterally. Such zones required special support. If such zones occur along the proposed tunnel line they are likely to be narrow, and not very serious.

[817]

“In the flood that occurred in the east portal region of the Claremont tunnel (flood water coming in from San Pablo Creek), the water filled the tunnel and stood against walls and roof as well as floor. Portions of the roof slumped down, causing considerable chambers that ran 20 or 30 feet above the tunnel roof line, A number of timbers slipped in laterally, and in places timber sets collapsed before the water was all pumped out. I mention this to illustrate the effect of water lying against an exposed surface of the formation.

“Along the proposed tunnel line conditions are very good from this standpoint, as no important source of underground water exists upgrade from the Orinda beds. It should be easy to prevent the water from the cherts working up into the Orinda region. During construction and later, the tunnel bore through the Orinda beds should be protected from possible influx of water from the surface drainage near the junction of the Tunnel Road and the Fish

(Testimony of Lewis Michael Larson.)

Ranch Road (called on map, Claremont Avenue Extension).

"As naturally exposed at the ground surface, the Orinda formation slacks down into soil and gives very few rock exposures. It is also subject to landsliding. Such a slide has taken place just below the chert contact and about 100 feet north of Station 134. Its movement has been northward away from the tunnel line. Another lies 50-100 feet south of Station 136 and has moved eastward. These are somewhat off the tunnel line, are superficial and have affected the ground for a depth of but 15-30 feet where the tunnel lies 200 or more feet below the surface. Landsliding in this formation does not take place when it is dry and normally occurs following a rainy season, especially one of above the average precipitation. As the slope of the ground is fairly steep near the east portal, and as it may be steepened and otherwise disturbed during tunnel [818] operations, the possibility of the sliding or slumping of this formation in the portal region should be kept in mind and guarded against.

"Support. I believe that in general this formation will stand well if reasonable care is taken in handling it, except near the east portal where the overburden is comparatively slight, and the surface influence may have weakened or may in the future weaken the material suffi-

(Testimony of Lewis Michael Larson.)

ciently to require artificial support.

"Oil and Gas. As noted above, under the Monterey Cherts, it is possible that some showing of oil and gas derived from the cherts may be encountered in driving through the Orinda formation. Their occurrence in this formation is so irregular that their presence cannot be definitely predicted but it would be well in driving the tunnel to watch for them and, in case their presence is noted, and they can be easily recognized in this formation, use care in blasting and have no open lights or flames. See further the statement under Monterey Cherts.

"Tunnel Earthquake Relations.

"As far as we have any definite evidence concerning the faults that cut the proposed tunnel line, their movements were connected with a period of geological activity that is past. There is no field evidence, or evidence from history or from our seismographs that any movements have taken place along these faults in recent times. While the evidence is wholly negative, I believe that it is reasonably safe to assume that no fault will by its movement cut or directly deform any structure that may be placed in the belt under consideration. That future movements will take place farther west near the base of the hills is probable, and it is also likely that the tunnel formations will be shaken by future earthquakes. The rocks should, however, stand

(Testimony of Lewis Michael Larson.)

satisfactorily even in the face of a severe shaking up by [819] an earthquake, any weak near-surface stretches in the region of the portals possibly excepted.

“Tunnel in General.

“In a general way the rocks and rock structures that would be encountered in the proposed tunnel are favorable from the engineering standpoint. The strata mostly dip at high angles and are intersected by the tunnel at a high angle to their trend. Such a condition restricts the width of belts that may show local weakness or much water, and presents the strongest arrangement of the type of strata involved, and the easiest to deal with in tunneling.

“Throughout the main belt of cherts, the rocks may be expected to be entirely self-supporting indefinitely; in the fault belt of cherts and in the Oridan, with proper care in driving and handling, the rocks should stand well and be self-supporting except possibly along certain shear zones which may require local reenforcement to withstand local pressure (not general weight). These statements do not refer to any measures that may appropriately be taken to prevent the detachment or falling of fragments or blocks from the surfaces exposed by the tunnel, but to general support of the mass of rock in the sides and roof of the tunnel.

(Testimony of Lewis Michael Larson.)

"Near the portals the rocks will probably be found weak and will require positive support to prevent movement or caving.

"The question has been raised as to the relative desirability of a single larger tunnel or two smaller ones. The relative advantages in operation of the finished tunnel or tunnels are outside the scope of this report. The geological aspect is related to construction and to the maintenance of the integrity of the finished structure. I do not know of any geological considerations that would indicate that the smaller tunnels are feasible and a larger one not. [820]

"It is certain that in cases where support is necessary or resistance to any possible earth pressure must be provided, the forces or stresses involved will be much greater with a larger tunnel and the problem of handling such conditions to that extent more serious. I have at present no reason to say that the larger tunnel would be impossible or that it would constitute a risk that should not be taken."

The rest of the report, I think, Mr. Larson, deals with outside conditions and was not used in arriving at your conclusions as to what you would have to encounter in driving these tunnels?

A. That is true. [821]

Q. Going back to the west portal, did you consider, Mr. Larson, in preparing your estimate, that

(Testimony of Lewis Michael Larson.)

there was an unknown and indefinite amount of stream wash and hill wash and creep at the west portal of the tunnel?

A. I took into account—

Q. Will you answer that question “Yes” or “No” and then explain?

A. Yes. I took into account what is shown on that sectional blueprint made by Dr. Louderback and I might mention that the other one apparently was not made by Dr. Louderback, but the one I referred to made July 7, 1930 indicated a certain amount of wash, and I noticed, too, when I prepared my estimate, that the tunnel portal was at 111 plus 42 on the north side and 111 plus 53—those are approximate stations—and the appearance that I would get from this Dr. Louderback drawing is that at that point there would not be any of the hill wash, and I noticed that in his remarks that most of this material would probably be removed by open cut. I must go into this in considerable length in order to answer your question on that. I noticed that in all of his remarks there were generalizations in his conclusions. He gave an answer or a definition to those generalizations and those are the things that influenced me more than the detail on which he based those conclusions. I took into account the fact that there might be a slight covering over a certain portion of this westerly section, and that is the reason why I first

(Testimony of Lewis Michael Larson.)

used the drift method and then later used the wall plate method, planning to leave the timber in in that portion. But I must say this, that the grouping on the wall plate section indicates that it covered only the Monterey sandstone section.

Q. Mr. Larson, I was directing my question to the hill creep and soft material that is shown on the blueprint which is referred to in Dr. Louderback's report at page 1 as being the map and profile [822] of May, 1932, which you have just said was not prepared by Dr. Louderback, but is referred to in his report, and for your information I will say that it was prepared under his direction and it is the profile of the location at which the center line of the tunnel was located, and the location of the profile shown to you is not the location upon which the tunnel was constructed?

A. Of course, I previously testified to that Mr. Tinning, that I did not have the blueprint, consequently I could not give it consideration from that print.

Q. You did not have that information and on the tracing that you had, Exhibit 23, if you look carefully you will see the words, here, "Depth not known."

A. Yes, I note that.

Q. That was not on what you saw, was it?

A. Well, there was a line indicating it, a faint line.

Q. But there was not the words "Depth not known"?

(Testimony of Lewis Michael Larson.)

A. No.

Q. In other words, the data that was furnished on the blueprint of 1932, which was more complete, shows the stream deposit and hill wash to be considerably deeper and shows it to extend into the tunnel section, into the place required for the construction of the tunnel.

A. The average portal tunnel is at 111 plus 50.

Q. The average portal tunnel is at 111 plus 50?

A. That is the average.

Q. You understand from looking at this blueprint of 1932, the one here, the profile drawn in the actual location, that the profile is the center line of the 200-foot right of way required for the tunnel?

A. I note that.

Q. So that the tunnel south bore was on one side of it and the north bore on the other?

A. I note that.

Q. So that you were simply getting an average condition?

A. Yes. [823]

Q. Because when a tunnel is built on curves the south bore station is not directly opposite the north bore station?

A. It is not.

Q. The tunnel is a little longer, that is correct?

A. Yes.

Q. When you made your estimate you had no knowledge of this map which showed in connection with Dr. Louderback's report that the over-burden

(Testimony of Lewis Michael Larson.)

of stream deposit and hill wash and creep is indicated as being of an indefinite depth and extended into a portion of the section which was required for the construction of the tunnel bore?

A. I did not have this blueprint.

Q. You did not know that, nor when you made that estimate did you have data which showed that the hill terrace above the portals of the tunnel was apparently of considerable depth, unknown, but of considerable depth?

A. No, I had reference only to his information as contained in the written report.

Q. And that information, as we have gone through it, indicated that he did not know how deep that was?

A. No; he referred to a certain elevation of 950 and other things that helped me determine or helped me to arrive at a conclusion.

Q. 950?

A. That is elevation 950, I think.

Q. Would you mind looking at Exhibit No. 23? I will hand you my copy of it. Are the elevations shown in that exhibit?

A. The elevation of 800 is shown and 1,000 and 1,100. Can I mention in this connection that I used a scale to determine the elevation when I have a standard from which to measure? In that way I arrived at this.

Q. In other words, you took a scale of your own, your own engineering device, and scaled this off?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. And the figures on the right-hand side of the tracing made by Mr. Calhoun are figures to indicate elevation above sea level?

A. That is true. [824]

Q. And they are not in the same position?

A. They are with respect to the location of the tunnel, Mr. Tinning.

Q. What I have in mind is that the diagram attached to the report actually has the elevations on the left-hand side of the sheet indicated and that elevation 950 is practically the top, the highest point of the portion indicating sandy soil or stream terrace.

A. You refer now to station 115 plus 75, I believe, don't you? That is where elevation 950—

Q. Intersects?

A. Intersects, yes.

Q. Now, Dr. Louderback's report with respect to this hill creep states it is indefinite in depth, soft, weak and pervious to the water, and that the hill up to the point where it crosses the tunnel road, above the new tunnel, carries a considerable covering of hill wash and creep material, and that its depth could not be accurately estimated, and that it is 15 feet thick at the, about the 950-foot elevation. Now, Mr. Larson, you stated when you first testified, or earlier in your testimony here, that you had inspected the site and seen a pit near the west portal. Was that pit close to this point discussed here as being the 950-foot elevation?

(Testimony of Lewis Michael Larson.)

A. My recollection is it was about at that point.

Q. And I think you said that when you inspected that it disclosed a broken material and gave you no information as to what may lay underneath?

A. That is true.

Q. You saw that on the ground?

A. I saw that on the ground.

Q. He told you in that first portion of his report that the material at the west portal would erode easily and that it would have a tendency to carry water and that it extended up at least to and across the stream terrace, which apparently is the same place that you afterwards had drag lines and bulldozers shove off the surface material to take the weight off the portal of the tunnel [825] where that crack occurred?

A. That would be true as applies to the south tunnel, but probably not to the north tunnel, for the reason that the north tunnel lies under the slope of the hill coming down this way—

Q. The hill slopes—

Mr. Smith: Just a minute. Let him finish his explanation.

Mr. Tinning: He has.

Mr. Smith: He had not, he was in the middle of a sentence.

A. I want to state my reason for my answer. The hill slopes at this angle over the north tunnel, whereas over the south tunnel it reaches a position of repose, or more of a level nature, which would

(Testimony of Lewis Michael Larson.)

indicate that more of the stream wash might be found over the south tunnel than over the north tunnel, which proved to be true.

Mr. Tinning: Q. In other words, your conclusion from an inspection of the site was borne out by what you found when you excavated?

A. Well, I will have to go back to a statement that I made earlier, we found nothing in my examination of the ground which seemed to conflict with the conclusions that Dr. Louderback drew in his report.

Q. That is not an answer to my question, Mr. Larson. I asked you if you found when you excavated anything different from your conclusions drawn from your observation of the site. I am not asking about the report.

A. Very little difference, only one of degree, probably I should say this, I found a mud that I did not expect to find in the south tunnel.

Q. And that south tunnel was built south of the center line that is shown on the diagram attached to Dr. Louderback's report, the diagram you never saw when you made your estimate?

A. I believe so.

Q. And naturally, where the hill was sloping from the north to [826] the south there would be more material over the north tunnel? There is a right of way 200 feet wide, and there would be more material over the north tunnel portal than

(Testimony of Lewis Michael Larson.)

there would be over the south tunnel portal, which was adjacent to the stream you have described.

A. Yes.

Q. And the mud which you found when you excavated was near that stream bed? A. Yes.

Q. And what you would expect to find on a washed hill side below a stream where the rocks were not carrying a stream? A. Yes.

Q. In hill creeps, alluvium materials such as you observed it?

A. Or even, I think, in the disintegration that would result from water flowing over a formation that would be subject to being influenced by air and water contact.

Q. Now, my question is with respect to when you found the cracking material that you testified that you had gotten in and taken care of when you were getting underground in your excavation, was that on this hill terrace that is shown in Dr. Louderback's map?

A. It was under that hill terrace, but not in the south tunnel. In the south tunnel I don't know whether any of that creep was over the south tunnel or not; that is something I am not competent to answer, but I assume that it was.

Q. That material that you removed when you got these hurry-up operations under way and brought down the bulldozers and caterpillars, and built a special road from the tunnel road to the ex-

(Testimony of Lewis Michael Larson.)

cavation that you were driving, and getting underground, was in this terrace area, was it not?

A. It was in the terrace area, but let me qualify that by a statement that I do not believe it was the hill creep that Dr. Louderback's report referred to. I think it included some hill creep and some material in place.

The Court: We will take an adjournment now until tomorrow morning at ten o'clock. [827]

(An adjournment was here taken until tomorrow, Thursday, April 21, 1938, at ten o'clock a. m.)

[828]

Thursday, April 21, 1938;

10:00 O'Clock A. M.

LEWIS MICHAEL LARSON,

Cross Examination (continued).

Mr. Tinning: I just handed the witness a copy of Exhibit 22 to follow.

Q. From what, Mr. Larson, you were able to find in the portion of the geological report including the diagrams, did you conclude that you would require approximately 40 feet to go underground to reach the sandstone?

A. An average of 40 feet; possibly less in the north tunnel; possibly a little more in the south tunnel.

(Testimony of Lewis Michael Larson.)

Q. What caused you to conclude that you would probably require 40 feet of excavation through soft, unsupported material for 40 feet on the north tunnel?

A. I really formed part of the conclusion from the little drift that was driven into in the vicinity of the north tunnel, coupled with the sketch,—the sectional sketch of the tunnel,—which indicated that there would be some float. I am referring now to the one of 1930, July 7th; I think that was the date.

Q. The only one you had seen?

A. The only one I had seen; and I concluded from that and the geological report that there would be a minimum amount. I assumed 40 feet as a safe amount, because, not only on the geological report but based upon previous experience that the portal sections generally require a little different treatment from the other sections.

Q. Well, isn't it a fact that in the portal section, all materials which you find in this Coast Range always require different treatment than the interior or deeper parts of the tunnel?

A. I think that is a matter for too much information there, Mr. Tinning. I cannot say they always do require it.

Q. Well, isn't it a fact that where you have erosion and weathering, [829] the other conditions of exposure, and moisture and air and sun, that, for rocks and material in this region where you

(Testimony of Lewis Michael Larson.)

have this type of sandstones to reach, the materials erode and soften, and therefore you have to give them positive support?

A. That is a position that I took; and it is customary to give that consideration in approaching a tunnel opening, to give it special support.

Q. Isn't that exactly what my question was: that it was customary and ordinary to do that?

A. Yes, I believe it is.

Q. And in addition to the fact that you have soft material, you have something that you mentioned in connection with the Old Tunnel: your observation of that, that the overburden is low in those places; so, you have an unstable, soft condition immediately above the top crown of your tunnel?

A. It is a safe assumption; being a safe assumption, it is one I customarily follow.

Q. Will you point out any place in Dr. Louderback's report where you found anything that indicates that the soft material at the mouth of the west portal of the Broadway Tunnel, on either the north or south tunnels, would be 40 feet in depth?

A. There is nothing to say the distance.

Q. So, you drew your own assumption from your experience, didn't you?

A. That 40 feet of drift in the west end would be sufficient, and 20 feet of drift in the north end would be sufficient, by the drift system.

Q. Yes, the drift system. Thereafter, you passed through that material at the mouth of the tunnel,

(Testimony of Lewis Michael Larson.)

and came to the Monterey or Sobrante Sandstone; and do you consider that, when you reached the point 110 feet in the tunnel,—in the north tunnel,—that you had reached the sandstone?

A. I did not know that I had reached the sandstone. I did know this, however: that it did not have the quality that I had expected it would have, from having read Dr. [830] Louderback's report.

Q. Yes. You have told us that before. I am asking you now whether you had reached the sandstone when driving the north tunnel, when you had driven it 110 feet.

A. I will have to qualify that by saying I am not a geologist and do not definitely know whether it was sandstone or not that I was in.

Q. In other words, you cannot say?

A. I cannot say that I was in sandstone.

Q. With respect to the south tunnel which you drove, I think you said 92 feet? A. Yes.

Q. Had you reached sandstone when you had stopped your drift operations at 92 feet?

A. I thought I had, in the three lower drifts; that is, the lower drift, the second drift and the third drift; and assumed that formation, which was just showing signs of stiffening, would continue to increase in depth and cover the whole of the tunnel.

Q. When you say the first, second and third drifts—

A. Those were the three lower drifts.

(Testimony of Lewis Michael Larson.)

Q. Looking at Plaintiff's Exhibit No. 28—I don't think it will be necessary for you to come down here, Mr. Larson, unless you would like to; I just wanted to be sure I understood.

A. Yes.

Q. The lower drift, second drift and third drift progressively rising? A. Yes.

Q. In that part of the tunnel, you had found, at a distance of 92 feet into the hill, material which appeared to you to be the sandstone?

A. That is true.

Q. Now, in reading Dr. Louderback's report, I suppose that you had in mind that he stated that these materials to be encountered might be expected to slack on exposure to the atmosphere, and to exfoliate and crumble down? I am referring to what he says under "Monterey [831] Sobrante Sandstone," on page 13, in the first paragraph.

A. May I have your question, again, please?

(Pending question read by the reporter.)

The Witness: A. I should say yes, so far as you have gone, Mr. Tinning; but, if you will read a little bit further, he qualifies that statement.

Q. Mr. Larson, that is a statement on your part as to what he does; I am asking you if you read that; and, having read it, that you might expect exfoliation of this material where exposed to air—I suppose you mean, by "qualification," that the last sentence in that paragraph, in which he says—

A. The last sentence.

(Testimony of Lewis Michael Larson.)

Q. Yes. "This should cause but slight difficulty during construction, and when the formation is protected by the finished tunnel lining this action will no longer be effected."

Mr. Smith: That is not the last sentence.

Mr. Tinning: I am reading this, Mr. Smith.

Mr. Smith: I know; but you said the last sentence of the paragraph. That is not the last sentence.

Mr. Tinning: The last sentence in the bottom of the page; thank you.

Q. That is the sentence you referred to?

A. No; it is not. It is in the last sentence of the first paragraph, under "Monterey Sandstone."

Q. Then, you are referring to the sentence: "Where it is but a thin mass between the tunnel roof and the overlying disintegration products it is desirable to plan for its artificial support or removal even if it stands well on first opening"?

A. Yes, where it is but a thin mass.

Q. Yes. How is that affected by exfoliation?

A. Where exfoliation occurs, Mr. Tinning, it will occur—the surface exposure; [832] that is the part that is exposed to the atmosphere; if it is only a small layer, it will probably penetrate the whole of the body and cause exfoliation; but, where you have a mass, it only hits the surface, and the loose portion of it does not exfoliate until that mass is removed.

(Testimony of Lewis Michael Larson.)

Q. By "exfoliation," you understood, did you not, the quality of the material when moisture or air reaches it to expand like lime that is slaked,—it gets bigger, thicker, and occupies more space?

A. Well, "exfoliation," is I understood it, Mr. Tinning—it is a tendency, along the line of your explanation, but causing it to flake off.

Q. Well, when it flakes off, it expands, does it not,—thickens?

A. That is a technical question; and one I am not qualified to answer.

Q. "Slacking,"—what do you call that?

A. "Slacking," as I intended it, means that small particles will gradually come off, and expose new surfaces which, in turn, will disintegrate.

Q. The disintegration process; it crumbles down into the sand,—the small particles? A. Yes.

Q. You understood, from the last sentence of the last portion of the last paragraph on page 13, that you might expect slow slacking during construction, and that that would not cause particular difficulty; but, when the formation is protected by the finished tunnel lining, this action will no longer be effective?

A. Yes; that is what the Doctor said; that was my understanding, yes.

Q. When you planned to keep your concrete lining within 300 to 350 feet of the excavation point, you had that in mind, did you?

(Testimony of Lewis Michael Larson.)

A. I had that in mind, yes; and had provided for it, by making that a timbered section.

Q. You mean, by that, providing that you were permitted to leave [833] the timbers here in that section?

A. That was my plan. My estimate shows that.

Q. Was it likewise one of the reasons that you planned the next 720 feet of tunnel in the Sobrante formation to be timbered permanently?

A. That was precautionary, purely.

Q. It had nothing to do with exfoliation or slacking?

Mr. Smith: Just a minute. I submit the witness had not completed his answer.

Mr. Tinning: I have a right to ask him a question.

Mr. Smith: You have no right to cut the answer off.

The Court: We have been getting along so nicely here. The witness, under the rule, will answer the question; and then he may explain it, if he wishes. Proceed. Read the question.

(Pending question read by the reporter.)

Mr. Tinning: See—The witness did not answer my question.

The Court: Q. Answer the question.

Mr. Tinning: Q. The question, Mr. Larson, was: Was one of the reasons that you planned to maintain the timbers permanently in the next 720 feet, under the method you proposed, because of

(Testimony of Lewis Michael Larson.)

the slacking and exfoliation qualities of the materials, through the Monterey Sandstone through which you were driving, were exposed?

A. No; not entirely.

Q. Was it, in any degree?

A. Yes, in part.

Q. Now, explain it.

A. My intention, as I tried to explain, was to be ultraconservative in my estimate. I did not think that it would be necessary to use the timbers throughout that 720 feet; but I introduced it, as a precautionary measure, to make my estimate what I would term "safe." That had more to do with it than any fear of slacking or a tendency of that material to exfoliate, before it would require other support. [834]

Q. I will show you one of our copies of your Exhibit No. 27,—the method that you proposed for excavation; and the exhibit shows a shaded portion on the westerly end of the two tunnels, which you testified was the distance of 720 feet plus 20 feet at—

A. Plus 40 feet.

Q. Yes—The legend on that exhibit shows that you expected, within the shaded area, to install permanent timbering?

A. That is correct.

Q. And you considered, as I understand it, that permanent timbering was advisable, or necessary, in those portions of the tunnel, when you prepared your estimate, because the ground there, you assumed, was self-supporting?

(Testimony of Lewis Michael Larson.)

A. I cannot say "Yes" to that, Mr. Tinning. I will have to say positively "No." I did expect a good portion of that to be self-supporting, but, as I stated before, it was a precautionary item put in there. I did not think the full amount of 720 feet would really require this; but neither did I feel, Mr. Tinning—Let me enlarge on it—that any of the "B" section would be ordered; I did not think that liner plates would be required; but those things were put in merely to make the estimate safe.

Q. Well, the District Engineer had a right to order "B" section if he wanted?

A. He had a perfect right to order it, yes.

Q. In indefinite amounts?

A. Yes. I cannot say "an indefinite amount."

Q. Well, you considered he could order any "B" section put in, and you figured the price per foot you thought was proper to pay?

A. Yes; but I wish to enlarge on that, and make myself understood, and make my position clear: It is customary, in all estimating, I believe, or, at least, that I have had anything to do with, [835] to have a standard section and then another section, or something whereby, if the Engineer has the right to depart from the standard—I have always thought that to be a legal interpretation, or legal precaution; and it did not mean, because the "B" section was indicated there, that the Engineer had any intention—I am speaking of my mind and my thought—had any intention whatever to order it; but merely

(Testimony of Lewis Michael Larson.)

to give him the right to depart, even to an exaggerated degree, from the standard section. That is what I had in mind.

Q. In other words, if he met, in the driving of this particular project, conditions of great severity, he had a section to meet those conditions with?

A. He could go anywhere between the standard section and the "B" section.

Q. That is your impression: that he could do anything between "A",—the standard section, which was installed in the tunnel under the plan of timbering which you have here—anywhere between that and the "B" section; that was your interpretation of these plans and specifications?

A. That is my thought, within certain limits. I will say within certain legal limits. I don't know what those legal limits are.

Q. I am not discussing legal limits. We are talking about this direct question. Did that "B" section call for an invert? A. It did.

Q. It called for a thicker wall? A. Yes.

Q. It is your understanding that, instead of putting an invert in, when you were preparing your bid, he could ask you to put in a strut across half-way, say, at the partition line,—something of that kind? Is that what you mean: anywhere in between?

A. I think he provided for certain bars in there, —a heavier—that is, stiffer point where the venti-

(Testimony of Lewis Michael Larson.)

lator platform was, for a distance of about 15 [836] feet above the floor slab—He indicated, there, some rods that had a tensile tendency, from compression members, as I remember it. I am not trying to state what the Engineer had in his mind; but my interpretation of that and he had a right to depart from the specifications where, in his judgment, it was necessary.

Q. And when he departed from the plans, he could go anywhere, between the standard "A" section and the standard "B" section, that he thought was right?

A. That would be my interpretation. [837]

Q. You understood that this sandstone might require permanent support and you provided for it by leaving the timbers in in your proposal, and you hoped that you would not need them all: is that a fair statement?

A. Hardly, Mr. Tinning. I should say rather that I had in mind that a portion of it would require positive support, and, as I explained before, the other was purely precautionary, but I had taken
• Dr. Louderback's own definition of these general statements which are contained in his conclusion as my guiding star.

Q. You have told us that before, Mr. Larson, a number of times, and I will assume in this examination that the general statements were your guiding star, but we are now coming back to some specific statements. You said the other day, I think

(Testimony of Lewis Michael Larson.)

it was the second occasion when you visited the site of the tunnel, that you visited Dr. Louderback and discussed this with him.

A. It is my recollection it was the second day.

Q. And that would be sometime in March, 1934?

A. It must have been, yes, in the early part of March.

Q. The early part of March, 1934?

A. Yes.

Q. Because you went away March 20 and were gone a month?

A. That is about correct.

Q. You went to see Dr. Louderback at what place?

A. At his office in the University grounds.

Q. Is that in Bacon Hall, a round brick building?

A. I believe that is the name of the hall.

Q. Who was present when you discussed this matter with Dr. Louderback?

A. Mr. Fontaine, Dr. Louderback, and myself.

Q. Had you telephoned Dr. Louderback for an appointment to see him?

A. Not that I recall.

Q. You have no recollection?

A. I have no recollection of it. [838]

Q. But you would not say that you did not?

A. I would not say I did or did not.

Q. At the time that you went to see Dr. Louderback did you tell him that you were preparing an estimate?

(Testimony of Lewis Michael Larson.)

A. I am not sure that I told him I was preparing an estimate, but I did ask him about the geology of this tunnel, and possibly I might have said that I was preparing an estimate. I am not clear on that.

Q. Did you not at that time and place, at his office, ask him or state in substance and effect that you were preparing an estimate for a bid on the Broadway Tunnel and that you had seen his geological report, and that you wanted to talk to him a little more about the Monterey Sobrante sandstone referred to in his report? A. No.

Q. The claimed formation that would be encountered?

A. No, my recollection is that I had not seen the report at that time.

Q. To make your answer definite, it is your recollection that you did not tell him that you wanted to discuss that matter, the first material that would be encountered as you drove the tunnel from the west toward the east, the Monterey Sobrante sandstone?

A. I have no recollection of that particular statement.

Q. And it is your further impression that you went to see Dr. Louderback before you had read his report? A. I believe that is true.

Q. Then is it not a fact that at that time and place you asked him if he could tell you something more about the material than his report stated?

(Testimony of Lewis Michael Larson.)

A. I don't remember that I asked him in that way, Mr. Tinning.

Q. Then your answer would be, so far as you can recollect, no?

A. That would have to be my answer.

Q. Did he tell you, following along in the conversation, that [839] he did not know of any tunnel or other construction work that had been built in the Monterey Sobrante sandstone?

A. He possibly did; I could not say yes positively to that.

Q. Did he tell you that you had experienced a narrow belt of this sandstone in the Claremont tunnel, just a few feet?

A. I have no recollection of that.

Q. You have no recollection of that? A. No.

Q. Did he explain to you that there was no surface exposure of the formation and that only residual soil appeared on the surface? In other words, that there were not any outcrops of these sandstones, did he tell you that?

A. I have no recollection that he told me that.

Q. Didn't he tell you he did not know how deep you would have to go to find cementation in this formation?

A. I have no recollection that he made that remark.

Q. And that the only thing that he knew was that the formation was mainly sandstones which weathering disintegrated?

(Testimony of Lewis Michael Larson.)

A. I do not remember the details to the point that you are stating them, Mr. Tinning.

Q. Did he tell you and Mr. Fontaine that he thought in making up your estimate that you should consider the sandstone as the worst part of the tunnels, and that a large part of it would require positive support?

A. I don't remember it to that effect.

Q. And that by so considering the sandstone and the conditions to be met in going through them, if the actual conditions encountered were better it would be to your advantage, to the contractor's advantage?

A. I have no recollection of that detailed statement.

Q. Now, at that conversation following the discussion respecting the sandstone did Dr. Louderback tell you that you had had experience [840] in the cherts formation in the Claremont Tunnel, which was similar?

A. He may have; I do not recall it; I won't deny it.

Q. And that you undoubtedly would have the same kind of trouble experienced in the Claremont Tunnel in driving the Broadway Tunnel through the cherts?

A. I can't remember the full details.

Q. Was that in substance what he told you?

A. If you will permit me I will tell you what he told me as I remember it.

(Testimony of Lewis Michael Larson.)

Q. I think we had better follow through with specific statements.

A. I don't remember that detail.

Q. So far there is nothing that I have asked you that you remember specifically?

A. No, I don't remember those details.

Q. On the other hand, I understand that you do not deny that they might have occurred, but you have no recollection of them?

A. I have no recollection of them.

Q. In driving through the cherts, did he tell you that you could expect local smashing up of rock, falling out of rock and loose material, both where the rock was wet and dry?

A. I frankly believe he did not.

Q. That he did not?

A. I believe he did not.

Q. So that your statement is your present recollection is it was not made, as far as you know?

A. So far as I know it was not made.

Q. Did he further tell you there was some hope in driving through the Broadway Low Level Tunnel that you would not get as much water as you found in the Claremont Tunnel?

A. It is reasonable to assume that he did say that, but I don't remember that he said it.

Q. Did he tell you in that conversation anything about the Orindan formation?

A. He did.

[841]

Q. In what he said to you, did you tell him, when he brought the statement up, that you did not

(Testimony of Lewis Michael Larson.)

need to discuss the Orindan formation with him, because you thought you understood the characteristics of that formation due to your experience in the Claremont Tunnel?

A. I doubt that I made that statement.

Q. Then there is nothing in the various items of conversation that I stated to you that you feel now at this time that you can remember as something that was said to you at the time of that conversation?

A. No.

Q. What did Dr. Louderback say to you according to your recollection?

A. According to my recollection he stated that—we will deal with the Orindan first, because that is the subject mentioned—there had been some movement.

Q. Would you mind giving what you remember of the statement that you say he made? Would you mind starting at the first of this and go through with it, if you can? We had trouble, you remember, in going backward yesterday.

A. I will begin at the west end first. My recollection of the conversation was this, that "You will undoubtedly find some float material or hill wash over the west end of the tunnel, and on the Orindan side, there has been a movement of Orindan, but it is off the tunnel line. However I made a report on that." And to the best of my recollection, in fact I know it seems to me he meant why bring up something that you can get from the district? I

(Testimony of Lewis Michael Larson.)

have made a report on it and I considered that as terminating the conversation. That, in substance, is my best recollection, except this one thing he said, "There is an exposure of cherts," and I will try to repeat it as nearly as I can verbatim—"up on the Fish Ranch Road, this side of the divide, I would advise you to go and see that. My recollection is that it was used, at least [842] I have been told that it was used as a quarry or site of a quarry."

Q. When you say "my" that is in quotation?

A. As nearly as I can remember that conversation. "My information is that it has stood practically in the same condition for the last thirty-five years." Now, in substance, not in detail but in substance, I believe that covers the whole of the conversation with Dr. Louderback regarding the Broadway Tunnel, to the best of my recollection.

Q. You only saw him once?

A. I saw him only once that I have any remembrance of prior to the bids.

Q. That is the only thing that affects this?

A. Yes.

Q. It is true after the tunnel was under way and you were working there you saw Dr. Louderback frequently at the tunnel?

A. Yes, frequently.

Q. He was out there to see you?

A. Yes, frequently.

Q. You and he talked together numerous times?

A. We did.

(Testimony of Lewis Michael Larson.)

Q. But all that we are discussing now is the matter that misled you in connection with the specifications and in the preparation of your estimate. Now, this was sometime early in March and Dr. Louderback's report you had not seen at that time?

A. I had not seen it at that time.

Q. How did you come to go to see Dr. Louderback?

A. I had known Dr. Louderback for a number of years and I thought possibly I owed him a friendly visit, if nothing else.

Q. So that you simply called on him and while you were there, and you talked about this tunnel because you were interested in it, while you were there you discovered for the first time that he had made a report?

A. No. I did not discover it for the first time. I read that in the specifications, that there was a geological report, but I had not seen it at the time I saw Dr. Louderback. [843]

Q. A few moments ago you said if the District has it I will go and get it from the District, or something to that effect.

A. I would like to have my testimony read, if you misunderstood it.

Q. I do not think I misunderstood it.

A. I believe you are misquoting it.

The Court: Read the record.

(Record read by the reporter.)

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Q. Did Dr. Louderback say "Why bring it up, I have made a report on it"?

A. He did not use those words, but that is the import that came to me. I could not exactly quote his words after this number of years, I am giving you my recollection of it.

Q. I did misstate you in my question. I understood when you stated "I" that you were referring to yourself. A. No.

Q. Why did you take Mr. Fontaine with you if it was a friendly visit?

A. Mr. Fontaine and I were to collaborate on the tunnel, that is, he was to give me the benefit of his advice, and whenever we made these inspections over the site Mr. Fontaine and I went together, with a view to discussing the different features, and at the end of this second visit I believe that I suggested, "Let us drop around to see Dr. Louderback, we are in the vicinity." And my recollection is we drove back over the same ground to the west portal and then around to see the Doctor.

Q. Then at the time that you saw the Doctor—you started working on this same estimate about February 27, I think you actually arrived in Oakland? A. I believe so.

Q. And this was a week or so along in March, and at that time you had not received from Mr. Orselli the copy of Dr. Louderback's report?

A. I never did.

Mr. Smith: There is no evidence he did. [844]

(Testimony of Lewis Michael Larson.)

A. I never received a report from Mr. Orselli.
Mr. Tinning: Q. From Mr. Calhoun?

A. No, I had not received it at that time, not at the time I visited Dr. Louderback.

Q. You are positive about that?

A. I am pretty positive about it, yes, very positive.

Q. The first time, then, that you were told that you might anticipate float or stream material at the surface of the west portal was when Dr. Louderback told you in his office?

A. Yes.

Q. And you had been up to the site and inspected it?

A. I had.

Q. You saw a terrace with growth on it, and you saw a stream running down to the south of the tunnel site, in fact I believe over where the south tunnel was later built, you saw all of those things, but you did not know that there would be stream float on that approach until Dr. Louderback told you?

A. I did not state that, that is an exaggeration; I did not expect much of it. My experience has taught me that there is float in every stream where a hill flattens out, that is where valleys are made.

Q. Later on when you read Dr. Louderback's report regarding this entrance under this mountain, driving underground, did you read the paragraph appearing at the top of page 14:

"As at the surface of the ground only the weathering products are to be observed, before actually driving the tunnel through, the condi-

(Testimony of Lewis Michael Larson.)

tion of this formation along the tunnel line and depth to the top of the fresh, firm rock can be determined only by test holes or borings”?

A. I read the whole of his report for the pages that I mentioned.

Q. Did you make any test holes or borings?

A. I did not.

Q. There was a warning placed in that report before it was done, before the underground work was done it would be wise to do it, was there not?

A. It says, “The depth of the deposit can [845] be determined only by test borings. I do not think it refers there to being a wise thing for the contractor to do.

Q. Anyway, you did not do it?

A. We did not do it, no.

Q. And you had referred to this drift which was mentioned to Dr. Louderback, and which you have already said was entirely removed by the excavation for the portal building, and no portion of which extended into the tunnel proper.

A. That is correct.

Q. Now, in that you saw sandstone, and Dr. Louderback’s report, what we have just read before refers to this, which says if they continue that they would be the kind of material you would find in the tunnel?

A. That is a proper interpretation of his report.

Q. And you did not find this continuing; when

(Testimony of Lewis Michael Larson.)

you graded out that tunnel for your portal buildings these sandstones were entirely eradicated?

A. I would not say entirely eradicated, but the firmness they showed in the tunnel was entirely eradicated.

Q. The layer of sandstone at the east end of that drift, which was not in the tunnel, at all, did that layer of sandstone continue on into the hill?

A. Toward the tunnel line, you mean?

Q. Yes.

A. My recollection is that it did for a distance, possibly, of ten or twelve feet, I mean running from the excavation made in the open cut and later.

Q. And did that run continue beyond the 10 feet into the place where the face of your tunnel was?

A. It did not reach the face of the tunnel; how far is only an approximation on my part, but to the best of my memory I know it extended about that distance, but did not reach the face of the tunnel.

Q. Then before you went underground at all you knew that the sandstones exposed in that drift did not extend in to where the tunnel was to be excavated? A. That is true. [846]

Q. You knew also before you went underground that the surface material adjacent to the open cut was slidy?

A. Yes, I knew it was not stable.

Q. You knew they were unstable? A. Yes.

Q. I believe your first tunnel excavation was

(Testimony of Lewis Michael Larson.)
made around the 1st of August, 1934?

A. I think you are correct.

Q. And by that time you knew that the conditions that ~~you~~ were to encounter in going underground were different than you stated you had assumed they would be? A. That is true.

Q. And you went on with the work?

A. I went on with the work.

Q. And you made no protest?

A. It was not my province to make a protest.

Q. You made none?

A. I made no protest, no.

Q. When you were traveling around on these inspection trips and during the observation that you and Mr. Fontaine engaged in in the spring of 1934 did you consult with the Safety Engineer of the Industrial Accident Commission of the State of California, Mr. C. H. Fry, regarding the gas conditions and what would be required?

A. I think it was Mr. Lowell, and Mr. Lowell called Mr. Fry into the conversation.

Q. And at that conversation with Mr. Fry Mr. Lowell was also present? A. Yes.

Q. Were you told that the type of formation through which this tunnel was driven would be particularly bad?

A. I have no recollection of it, and if I had been told that I would have placed Dr. Louderback as an authority ahead of the Industrial Accident Commission.

(Testimony of Lewis Michael Larson.)

Q. Will you state now that in 1934, when you were preparing your estimate, that you were not advised by Mr. C. H. Fry, Mr. Fred Lowell, Safety Engineers of the Industrial Accident Commission [847] of the State of California, and when you called upon them in their office with Mr. Fontaine, that the type of the formation through which this tunnel was to be driven was ground that was particularly bad?

A. I have no recollection of that conversation.

Mr. Tinning: Gentlemen, we have a copy of a letter sent to us by the Industrial Accident Commission under date of April 19, 1935, addressed to Mr. T. M. Price, Six Companies of California. We are perfectly willing to introduce our copy of this letter if you desire rather than ask you to produce the original. It will be stipulated that Mr. Price was the Project Manager at the time stated, will it not?

Mr. Marrin: You offer that. We are going to object to it.

Mr. Tinning: Not as to the form of the offer?

Mr. Marrin: No, we will not object to the form.

Mr. Tinning: Will it be stipulated that T. M. Price was Project Manager of the Six Companies?

Mr. Marrin: Yes.

Mr. Tinning: If your Honor please, we offer in evidence a letter dated April 19, 1935, addressed to T. M. Price, who it has been stipulated was the Project Manager of the Six Companies of Cali-

(Testimony of Lewis Michael Larson.)

fornia, by C. H. Fry , Superintendent of Safety of the Industrial Accident Commission of the State of California, attached to the letter being a copy of a report by F. L. Lowell, who was mentioned by the witness as being present at the conversation, and ask that it be marked "Defendant's Exhibit F."

Mr. Marrin: We object to the introduction of this letter, if your Honor please, upon the ground that it is immaterial, irrelevant, and incompetent, on the further ground that it contains statements or purported statements by the author, which are purely [848] hearsay so far as the plaintiff is concerned, and we suggest that if they desire to prove a conversation they call the author of the letter and not try to prove it by introducing a hearsay statement in the form of a letter to Mr. Price.

Mr. Alexander: We join in the objection.

The Court: State for the record the purpose of your offer.

Mr. Tinning: The purpose of the offer, if your Honor please, is to show that a conversation was had between this witness and Mr. Fontaine with the Industrial Accident Commission's Safety Engineer at a certain time, that it was with respect to the tunnel, and with respect to bad ground conditions at the time when this gentleman was preparing the estimate, and that this statement was sent to the Six Companies of California on April 19, 1935.

Mr. Marrin: If your Honor please, we submit that that is not a proper way to prove a conversa-

(Testimony of Lewis Michael Larson.)

tion. The proper way is to call the persons who were present and have them testify, so that they may be cross-examined. This is a voluntary statement apparently made by Mr. Fry more than a year after the purported conversation took place, the contents of this letter are purely hearsay, and we object to its admissibility for that purpose.

The Court: If the purpose is to bring knowledge home to the man of the making of the statement—I will not admit the conversation—if you eliminate the conversation I think it will be admissible, but not to prove the conversation.

Mr. Tinning: I understand that. The offer is made for the purpose of showing that he had the conversation.

The Court: Is there anything in the letter indicating the conversation had with the witness on the stand in this matter?

Mr. Tinning: Yes. The witness did not deny that he talked to him. [849]

The Court: I am concerned about the admissibility, and I am trying to keep the record straight.

Mr. Wittschen: May I make one further observation, not only that it is a letter directed by the Industrial Accident Commission to Mr. Price, the Project Manager of the Six Companies in 1935, in which he states that away back the year before he had warned this witness as to conditions, and he was continuing that warning during the time that they were driving the tunnel, which certainly is admissible on the main ground as to the knowledge

(Testimony of Lewis Michael Larson.)

of conditions, and the fact that they continued on for a year after they got the warning.

The Court: I will admit it for the knowledge at this time.

Mr. Marrin: Exception.

Mr. Alexander: Exception.

Mr. Tinning: It is on the letterhead of the Industrial Accident Commission, State Building, San Francisco, April 19, 1935.

DEFENDANT'S EXHIBIT F

T. A. REARDON, Chairman,
WILL J. FRENCH,
MEREDITH P. SNYDER,
Members.

State of California
Department of Industrial Relations
Industrial Accident Commission,
State Building,
San Francisco,
April 19, 1935.

Mr. T. M. Price,
Six Companies of California,
P. O. Box 120,
Berkeley, California.

Dear Mr. Price:

On April 15, 1935, F. L. Lowell, our Supervising Mining Engineer, before leaving for a

(Testimony of Lewis Michael Larson.)

trip to Mariposa County, called my attention to the conditions in your two Lower Broadway Tunnels. I am enclosing a copy of his memorandum.

You realize that it is the duty of the employer to take whatever steps are necessary to make his place of employment safe, and it is not the duty of the Industrial Accident Commission to do that.

For some time before the Six Companies bid on this project, we conferred with Mr. Larson and Mr. Fontaine and called to their attention the type of formation through which this tunnel was to be driven, and that the ground would be particularly bad, and that we were quite sure methane gas would be encountered. As we all know, the ground has been particularly bad from the start of the work.

Although I have not visited this project for some time, the information which I have received from various sources, makes me doubt the advisability of the type of excavating which is being done in the down-grade or north tunnel.

This matter should be given your serious consideration and every means known should be taken to prevent this ground from caving or running up in any way, causing conditions which would introduce the possibility of personal injury.

(Testimony of Lewis Michael Larson.)

Sincerely yours,
C. H. FRY,
Superintendent of Safety.

CHF:ES

Enc.

C.C. Wallace B. Boggs, Dist. Mgr., 1448 Webster St., Oakland. [850]

[Endorsed]: Received Apr. 20, 1935 Joint Highway Dist. No. 13, Frank J. Burke, Secretary.

Attached to that is the memorandum of Mr. Lowell.

April 15, 1935.

C. H. Fry,
Lower Broadway Tunnels.

It is my opinion that the Lower Broadway tunnels should be given frequent inspection, at least twice a week. The ground in these tunnels is treacherous and the tunnels are high. At the present time the up-grade or south tunnel has broken into the chert formation which is loose and has a tendency to run. It has to be breast boarded in the two bottom side tunnels and considerable water is flowing from the chert formation.

In the down-grade or north tunnel, the top heading which extends down to the top of the first segment above the posts is timbered and lagged overhead and these timber segments rest on a wall plate that extends in ahead of the main face of the tunnel. When this top head-

(Testimony of Lewis Michael Larson.)

ing cuts the cherts, it will have to be close lagged not only on the top but the sides as well on account of the running condition of the chert formation. The main or bottom heading is about 27 feet high and at present consists of soft sandstone. It is the intention of the Six Companies of California to drill this high heading from a "Jumbo" or portable staging that can be hoisted up and down in front of the face. The face will be practically vertical.

These tunnels should be watched carefully and frequently by our Department in order that the Commission may be informed quickly of impending danger to the men. From our conference today I am informed that it will not be possible to devote the time necessary for as frequent inspection of these tunnels as I would like to make and at the same time carry on the routine inspection in the field. I am, therefore, leaving tomorrow for Mariposa County on my regular County inspections.

F. L. LOWELL.

[Endorsed]: Received April 20, 1935. Joint Highway Dist. No. 13. Frank J. Burke, Secretary.

[Endorsed]: N. S. Dist. Ct. N. D. Cal. No. 20101-R. Deft's Ex. No. F. Filed April 21, 1938. Walter B. Maling, Clerk.

(The letter was marked "Defendant's Exhibit F.") [851]

(Testimony of Lewis Michael Larson.)

(After Recess.)

Mr. Tinning: Q. Dr. Louderback's report,—going into the Claremont cherts formation,—called attention to the fact that you would go through layers of cherts, which are the brittle, hard rocks, and thinner layers of shale, including a layer of clay, shale, sandstone, volcanic ash, some of this limestone, which, I understand, you also encountered in the Claremont Tunnel—Is my understanding correct on that?

A. I think I encountered some of the limestone in the Claremont Tunnel. I am not a geologist, and—

Q. Well, Mr. Larson, you stated, yesterday, in looking at that document, when you passed out of the Orindan the first time into the lava, that you saw there a hard rock which was designated as a limestone?

A. Yes.

Q. That is what you understood by Dr. Louderback's report: he states a layer of limestone—was it not—the type of material?

A. Today, I would put that interpretation on it, because I have not remembered the limestone referred to in Hulin's report. My memory brings it back to me that it was that. I had forgotten his remark about limestone. Consequently, I could not apply to any memory that I retained, at the time I read this, as being the same material.

Q. That was something in your own memory, then; you simply overlooked one of the characteris-

(Testimony of Lewis Michael Larson.)

ties that you had found as you drove through the Claremont Tunnel,—a small area there?

A. I had forgotten its presence in the Claremont Tunnel.

Q. You had not forgotten that volcanic ash that you encountered in the Claremont Tunnel, had you?

A. I had not forgotten that, Mr. Tinning; but I must say: volcanic ash, with water, is a different thing than volcanic ash, without water; entirely different; one will stand, and the other won't.

Q. When Dr. Louderback mentioned "volcanic ash," in his discussion [852] of the Claremont cherts, there was no qualification of the point we are discussing now, with respect to water—

A. Not at all; but I have always had to couple this with my own definition of what he termed these generalizations.

Q. You have told us that before.

A. Yes. I don't want you to forget it.

Q. When you were reading this report, and preparing this estimate, for the tunnel, of some two and a half million dollars, your memory did not refer back to your experiences in the Claremont Tunnel where you had gotten into volcanic ash?

A. I won't say I did not think of it; but I did not pay much attention to it, in view of what this geological report states this particular tunnel would be. That is the one I was dealing with.

Q. Although you had advice that volcanic ash

(Testimony of Lewis Michael Larson.)

might be expected in the Broadway Tunnel, you paid no attention to it?

A. No; because it would be self-supporting ground.

Q. Your generalities overcame the particular matters that were called to your attention?

A. Yes; because the Doctor had drawn the conclusion.

Q. You were relying wholly on him?

A. I have a great respect for Dr. Louderback's conclusions.

Q. Apparently. The strata of this formation intersects the surface at inclined angles; that is, they were steep?

A. Yes.

Q. And it was called to your attention you could expect the same conditions that you had in the Claremont Tunnel, where you had considerable trouble in the cherts?

A. The trouble—I will say this—

Q. Will you answer "Yes" or "No"?

A. It is very—

Q. Will you answer "Yes" or "No"?

A. May I ask that the question be read? [853]

(Pending question read by the reporter.)

The Witness: A. No. I should say "similar conditions" rather than "the same conditions"—But may I go ahead with my qualifying statement?

Mr. Tinning: Q. Yes.

A. Since bringing that matter up, I have had occasion to delimit the amount of bad ground in the

(Testimony of Lewis Michael Larson.)

cherts, on my own report to Dr. Louderback; and I find that the extreme distance could not be more than 196 feet out of it, taking my own report.

Q. For the purpose of clearing up the record—You are going back to something we went into yesterday? Will you give us the data that you have referred to? Is it between stations? How do you arrive at your conclusion?

A. I arrived at the conclusion by taking my letter and referring to the number of sets, where sets are indicated; and, where sets are indicated, multiplying that distance. Now, if it happened to be 13 sets, by 4—which my letter indicated was the spacing of those sets—and 13 sets times 4 is 52 feet. I analyzed my letter.

Q. In other words, you took the data in your letter, and worked it out; and your testimony, today, at the present time, is that you have given consideration to the computation, based on the data from your letter, that there was 196 feet of what I think you call “bad ground in the cherts formation” in the Claremont Tunnel?

A. That would be the extreme limit; about 108 feet of that being breastboard ground.

Q. Dr. Louderback’s report stated that these cherts are quite brittle and, when fractures did occur, produced in them by earth movement, it tended to remain open to allow the free movement of water. That was true in the Claremont Tunnel, wasn’t it, where you found fractures?

(Testimony of Lewis Michael Larson.)

A. Not that I recall. My records on the [854] details of the tunnel are not too clear; that is, if I would run into a fracture, whether it contained a great amount of water or not, I am not in a position now to remember.

Q. But it is true you had places in the Claremont Tunnel, when you were driving through there, where you had fissures that would fall off as you went through the cherts,—one case, at least 30 feet above the tunnel, and filled the tunnel with broken cherts that ran out of it?

A. I have no recollection of that.

Q. You have no recollection of that?

A. No.

Q. How much water did you encounter, in gallons per minute, as you drove into the Broadway Tunnel, in the portion where you were in charge up to April 30, 1935?

A. I believe there was very little record kept. The amount was relatively small. I have, since joining the Six Companies in the preparation of this case, gone into the records and I have some; but I do not happen to have them available right here.

Q. While you were working in the driving here, up to the time you left on April 30, 1935, was there ever a flow of water, in the north tunnel, of, say, 200 gallons per minute? A. I believe not.

Q. It was a comparatively dry tunnel, was it not?

(Testimony of Lewis Michael Larson.)

A. It was comparatively; I will say "Yes," because I wish to qualify it: that very little water in a tunnel, under certain conditions, where the ground is fractured, might cause a great deal of trouble; whereby, a big volume of water, in other ground, might cause little trouble.

Q. You had five to six hundred gallons per minute of water in the cherts in the Claremont Tunnel, and you never had anything approaching that in the portion of this Broadway Tunnel that you drove? A. I did not, while I was there; no.

Q. Now, you stated that you expected to find cherts formations in [855] the Broadway Tunnel comparable, to some degree, at least,—and perhaps better than you found in the Old Low Level Tunnel? I am showing you Defendant's Exhibit "C,"—photograph No. 10; which you remember you saw the other day, and which shows the cherts formation exposed on the south side of the Old Tunnel 430 feet in from the west portal?

A. I expected to find cherts as indicated in the position indicated there, where the laminations are close, where there are no cross sectional cracks that would cause a collapse, of any major amount, or even a small amount, of the cherts, because it was said to be self-sustaining; and, consequently, it could not, under any circumstance, slough.

Q. And that portion that is shown in that photograph was cherts of the character that you expected to find in the tunnel?

(Testimony of Lewis Michael Larson.)

A. There is a similarity.

Q. Yes. I will show you a photograph,—a view of the right-hand side of the down-grade tunnel—that is, the north tunnel, taken on February 15, 1936, at Station 124 plus 85, showing the area between 124 plus 85 and 124 plus 94; and ask you if that photograph is a fair representation of the type of cherts that you expected, when you looked at the Old Tunnel, to find when you drove through the Broadway Tunnel.

A. No; it is not.

Q. What is the difference?

A. This shows that it lacks self-sustaining, self-supporting qualities, in some parts; it might be in the lower part of this photograph, where the laminations are unbroken; it is difficult to say. Now, just drawing a conclusion, from a photograph, that that portion might be sound—

Q. That portion shown at the lower part of the tunnel up to the wall plate, or up to the ventilator pipe, is about the same height as you found in the Old Tunnel, isn't it,—16 or 17 feet?

A. I believe that estimate is approximately correct. [856]

Mr. Tinning: We will offer the photograph in evidence, your Honor, please, as a defendant's exhibit.

(The photograph was marked "Defendant's Exhibit G.")

[Set forth in the Book of Exhibits at page 358.]

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Q. I show you a photograph taken in the north tunnel—

Mr. Smith: Which is the top of the photograph?

Mr. Tinning: This is taken of the roof of the tunnel, your Honor; and, by holding the bottom of the picture away from you, you will see it.

Q. I will ask you to observe that photograph, Mr. Larson; and ask you if the chert disclosed, on the north side of the roof of the tunnel, which is standing unsupported after several sets were shot out of the roof of the tunnel—if that is the kind of cherts you expected to find in the tunnel, after your observation of the Old Tunnel.

A. I believe not, Mr. Tinning. I think I see there,—not too surely, though,—I think I see a fractured zone, whereby the formation of the laminations have been broken. It is difficult to say—to take this picture, and make any definite conclusion—draw any definite conclusion, excepting the one that apparently is evident; that it needed support, because the support is there; and I notice the lagging is relatively close. Apparently it is a broken formation, rather than a self-supporting one.

Q. I will ask you to look at the spacing. How long are the segments that form the boundary of this rock that is hanging down from overhead?

A. I would have to ask others about that. I would assume somewhere between 6 and 7 feet.

Q. So, you have a piece of rock hanging, or un-

(Testimony of Lewis Michael Larson.)

supported, in the roof of the tunnel, at least 6 by 6 feet?

A. It looks to me like part of it has fallen out.

Q. You think some of it has fallen out?

A. It looks that way, from [857] the photograph.

Q. And you, not being there, never saw this particular condition?

A. No; I had not seen it. I have not seen any of the cherts in the Broadway Tunnel.

Q. Would you say the section between those two rocks,—the double timbered segment which appears near the top of the picture and the first single rock, as you go further into the tunnel,—some 9 feet space in there—that there is anything supporting that roof at that point?

A. Yes, Mr. Tinning, there is.

Q. Is it the lagging?

A. The lagging or spiling,—whichever it is that they use there,—gives artificial support.

Mr. Tinning: We will offer this photograph in evidence as a defendant's exhibit.

(The photograph was marked "Defendant's Exhibit H.")

[Set forth in the Book of Exhibits at page 359.]

Mr. Tinning: Q. I show you a photograph taken February 15, 1936, showing the timbering on the south side of the down-grade tunnel, taken showing the section at Station 125 plus 53, and I will ask you to look at the cherts appearing below the wall plate in that portion of the tunnel; and ask you if it is

(Testimony of Lewis Michael Larson.)

similar to the material that you saw in the Old Tunnel.

A. Some portion of it is, Mr. Tinning.

Q. And the strata lie at about the same angle?

A. I believe so.

Q. So, it apparently is part of the same general formation?

A. Same general belt.

The Court: What would the distance be?

Mr. Tinning: Oh, I should say, five to eight hundred feet. That is a pretty wild guess, I am afraid.

The Court: Well, I just want to follow it; that is all. I understand.

Mr. Smith: You mean between the two tunnels—

[858]

Mr. Tinning: Between the two locations. This was pretty well toward the east, in this—

Mr. Wittschen: You mean toward the north?

Mr. Tinning: To the north, yes. We offer this picture in evidence, your Honor.

(The photograph was marked "Defendant's Exhibit I.")

[Set forth in the Book of Exhibits at page 360.]

[859]

Q. Now, it is true, is it not, at least in the portions of the tunnel that you had to do with, that there was no gas or any serious amount of oil encountered?

A. I don't remember any at all, Mr. Tinning, either gas, or any great amount of oil.

(Testimony of Lewis Michael Larson.)

Q. So that was one problem you did not have in the tunnel which Dr. Louderback stated you might have, and you did not have? A. That is true.

Q. In preparing your estimate I assume that you had that in mind, that you might have to meet that condition? A. I made provision for it.

Q. You were not in the tunnel when the cherts was intercepted or when you drove into the cherts?

A. Not the cherts belt that Dr. Louderback says in his report; this cherts that I have been taking as cherts was merely my own idea of what might have been cherts, the laminations that I discussed in the early part of my testimony.

Q. Dr. Louderback made some predictions as to where various formations would be met as to distance in the stations. Have you gone over those in his report?

A. I went over them in the sectional drawing, I think it refers to it here in the report; in fact, my recollection is that he mentioned between stations 118 plus 50 and 119 plus 50, or thereabouts.

Q. That is just about—

A. That would be the fault line, that is probably where we would enter it.

Q. That is where it was struck, is it not?

A. Very close.

Q. Likewise when you had passed out of Claremont cherts into Orindan formation at Station 131 or 132, also that formation was struck at the position that he indicated within a few feet?

(Testimony of Lewis Michael Larson.)

A. From the company's records I draw that conclusion, yes.

Q. You have been working on this whole matter so that is something [860] we can at least be definite upon, his predictions as to the points were very accurate? A. Were very close.

Q. You understood that when you went through the fault zone, the Wildcat fault, that you would expect to have considerable difficulty in driving this tunnel, didn't you?

A. Some difficulty, yes, Mr. Tinning, but I would like to say this, it was expected much less water would be encountered, consequently much less trouble.

Q. Dr. Louderback, in his report, did not attempt to predict the quantity of water with definiteness, he said that it could be hoped there would be less water? A. Yes.

Q. And except for water which would drain quickly, apparently the ground water that was stored when you went through that fault, your water conditions were a temporary matter and that turned out to be a fact, that the quantity of water rapidly dropped just as it did in the Claremont Tunnel?

A. Yes, together with the fact that he thought that there was probably a continuation of the Wildcat fault, which led me to believe, and possibly I am right in believing that, in having passed through the fault—I cannot say—but much of that water that was in the fault of the Broadway Tunnel would find

(Testimony of Lewis Michael Larson.)

its way into the Claremont Tunnel, which was nearby, and at a much lower level. That was my thought in the matter in reading his report.

Q. In other words, you connected the two tunnels together as to underground strata and you thought perhaps the Wildcat fault had drained off some of the water that you would have found in driving the Broadway Tunnel if the Claremont Tunnel had not been built several years before; is that what you mean?

A. I mean this, we left pipe in the lining of the Claremont Tunnel whereby the water from a higher elevation could enter the tunnel; [861] it was found to be practically chemically pure and the utility district wished to take that water, and it seemed reasonable for me to assume that much of the water from the Broadway Tunnel might find its way down there and leave the Broadway Tunnel as the Doctor predicted, with the hope that there would be less, and that hope was probably influenced by his belief.

Q. It is about a mile from the Broadway Tunnel No. 1 on Defendant's Exhibit B to the Claremont Tunnel, and you thought that the water in the ground rock below the Broadway Tunnel might be drained out by the opening in the Claremont Tunnel, so that you would not have so much water to contend with?

A. I thought that was entirely possible.

Q. Doctor Louderback did not say that?

A. No, he did not.

(Testimony of Lewis Michael Larson.)

Q. That was your conclusion?

A. That was my thought in trying to interpret his remarks that probably less water would be found.

Q. You do not claim that he misled you in that respect?

A. No, I do not. As a matter of fact, I believe there was less water. I can support the doctor in that.

Q. He also told you that this fault had caused more or less shearing and displacement along subsidiary fractures with rotation of minor blocks and crushing in certain areas, and that after you passed Station 120 plus 00 that he thought the cherts formation would be likely to be remarkably regular?

A. Yes.

Q. Now, according to your testimony respecting the Claremont Tunnel, you also had a like situation in the Claremont Tunnel, near the areas at the fault zone and as you passed in, after a few feet, as you said I think this morning, possibly 190 feet, your conditions improved, you got good ground.

A. I made mention this morning that 196 feet covered practically [862] all of the bad ground, according to my letter.

Q. You also stated there was about 120 feet of bad ground beyond the point where you made this barrel or concrete lining to take care of swell and fire, and then the balance of this 70 feet was spread out somewhere in layers or zones as you went far-

(Testimony of Lewis Michael Larson.)

ther east in the cherts; is that a fair statement?

A. Yes. I will say to my recollection that they were close to the major fault. That is my recollection.

Q. That is exactly what I was trying to refer to in his saying that you might expect to find subsidiary fractures with rotation of minor blocks and crushing in certain zones, as you passed from the west end toward the east, and that after you got past station 120 going toward the east that the structure appeared to be remarkably regular, although there are present some minor faults and crushed zones. That is what was found in the tunnel, is it not?

A. I am really not in a position to say positively. I have heard that they found a crushed area, I have heard that there was none of it self-supporting.

Q. You have told us that none of the tunnel was self-supporting.

A. Keeping in mind that I am speaking now from hearsay and not observation.

Q. You are testifying in a dual capacity here, as I understand it, as a tunnel expert, on the one hand, and you are changing over to testify to facts, and you testified as an expert that there was no part of this tunnel that was self-supporting.

A. That is my understanding.

Q. That is your testimony? A. Yes.

Q. Now, then, Dr. Louderback, with respect to the cherts, and the matter that I have just referred

(Testimony of Lewis Michael Larson.)

to, predicted that you might expect zones of crushing in the cherts.

A. Yes, if you limit [863] it to his general statement.

Q. Or to his specific statement, and your lode star is the general statement at the end?

A. Where he said it would be self-supporting.

Q. But as you read this report you saw these words, "although there are present some minor faults and crushed zones"?

A. I saw that, and then turned to his definition of what that was.

Q. You ignored the specific and went to the general?

Mr. Smith: He did not say ignored.

A. I did not ignore it, but it helped me put the interpretation on those general remarks.

Mr. Tinning: That means that you eliminated the specific and accepted the general?

A. No, I should say Doctor Louderback eliminated them.

Q. That is your conclusion?

A. That is my conclusion, and that is what I understood in his report.

Q. What did you do?

A. I concluded the formation from his conclusions, which stated that the ground would be self-supporting.

Q. And in taking his generalization you elim-

(Testimony of Lewis Michael Larson.)

inated the provision that we have just referred to on page 15 of the report?

A. In very large measure I relied, almost entirely, I might say, on Dr. Louderback's conclusions.

Q. You did not accept as a warning in arriving at those conclusions what he specifically says, "although there are present some minor faults and crushed zones"?

A. He had eliminated them and consequently I eliminated them.

Q. In other words, that is your interpretation that you eliminated them?

A. That is my understanding of the specifications.

Q. And upon that kind of an understanding you prepared your estimate on the basis of this tunnel being all in self-supporting ground?

A. Within limits—within the limits that Dr. Louder- [864] back stated.

Q. "The fault zone will be occupied by broken and possibly crushed cherts." Did you eliminate that? A. No, I did not.

Q. Did you eliminate his statement that driving through the cherts that the combination of crushed zones and water presented difficulties?

A. Might I ask you what you are referring to?

Q. I am referring to the top of page 16, but I am paraphrasing now.

A. Might I ask this, it is hard to follow. This refers to the fault zone, doesn't it?

(Testimony of Lewis Michael Larson.)

Q. The fault zone was referred to on page 15. Now we are coming to another paragraph on the top of page 16.

“In driving through the cherts, the combination of crushed zones and water often presents difficulties. The crushed rock (with or without water) may flow out into the tunnel almost like quicksand, or, if it holds together better, it may develop considerable pressure until the water pressure is relieved by free flow into the tunnel.”

Did you consider that in arriving at your opinion that this tunnel would be self-supporting throughout?

A. I did to this extent, Mr. Tinning, that often presents difficulties; he did not state that this tunnel would present difficulties, as I understand it, but he said in driving through cherts water often presents difficulties. That, to me——

Q. (Interrupting): You did not think that he was talking——

Mr. Smith: Just a minute: He was right in the middle of a sentence.

A. Is a general statement of what might be found in the cherts formation, which was limited in terms by his own conclusion, his own definition.

Mr. Tinning: Q. That was your own conclusion in reading this [865] report?

A. That was my conclusion.

(Testimony of Lewis Michael Larson.)

Q. You thought that this was a general statement, and that the final statement was the specific statement with respect to this tunnel?

A. Yes, that he had made his own definition of his generalization, and made a specific statement.

Q. I will go down two sentences.

"In certain cases where a broken or crushed mass of rock lies within intersecting fault planes, and thereby loses its bond to surrounding rock, it may slump down into the open working, leaving a chamber in the wall or roof."

Do you mean to say that you thought that was referring to what might occur in some other tunnel rather than in the Broadway Tunnel?

A. I considered that as a general statement of things that might be found in cherts, irrespective of any particular tunnel, a general condition that he had observed, and I can readily see he thought of other tunnels as well as the Broadway Tunnel.

Q. "If this is experienced at all in the proposed tunnel it will probably be in the southwestern fault zone mentioned above. If such unsupported blocks or masses are met, it would probably be best to let them down or remove them, before placing the concrete of the completed structure."

That was a specific recommendation that that condition was met with in this tunnel? A. Yes, if.

(Testimony of Lewis Michael Larson.)

Q. Did you in preparing your estimate, consider that recommendation if that condition was found?

A. No, let me explain. In my method of driving I had prepared to meet a condition where it would not be necessary in my judgment to let down masses of material. I intended to give support by the timbers that I indicated in my plan of operation.

Q. Do you think that the full face method of excavating which you indicated as your proposed method would hold blocks in the [866] roof?

A. The full face method is intended to be in ground that is self-supporting and in that case there would be no reason to prevent blocks dropping out of the roof; otherwise it would not be self-supporting ground.

Q. But still you did not plan to go to the full face method until you got into the cherts?

A. Not until I got through the fault zone of the cherts.

Q. You did not say that. May I see Plaintiff's Exhibit 27, please? The shaded areas indicate tunnel sections where permanent timbering was anticipated?

A. Yes, but a provision was made in the specifications in addition to that, an estimate of 100 feet of the Type B for each of the two tunnels, and in addition to that 100 feet of liner plate, or, in other words, I made provision in my plans or in my estimate to take care of approximately 30 per cent. of the tunnel whether necessary or not, for ground that

(Testimony of Lewis Michael Larson.)

would not be considered self-supporting, and the other 70 per cent. would be every such point which would probably be a little in advance of the broken formation, but within a few feet of the east portal.

Q. Then this diagram, Plaintiff's Exhibit 27, where the legend says the shaded areas indicate tunnel sections where permanent timbering was anticipated, did not represent the exact section where you planned to leave permanent timbers, but was simply a statement of quantity?

A. A statement of quantity would be more nearly accurate.

Q. Then when you testified that your section BB and your section AA, as shown in Plaintiff's Exhibit No. 27 were the sections in which you proposed to maintain permanent timbers you did not mean that they would occupy the first 760 feet of the tunnel, as you testified?

A. Let me make that clear. I will first of all say no. [867]

Q. Your answer is "No"?

A. No. The grouping together of the points that needed support in so far as an estimate is concerned, for convenience in the estimate, was brought together to cover the distance indicated there, coupled with a possible additional hundred feet of liner plates, and an additional hundred feet—I am speaking now of the individual tunnels—of the type B section, which seemed to be an ample safeguard

(Testimony of Lewis Michael Larson.)

against any condition that might arise in ground not self-supporting.

Q. Then it is your testimony now that the 720 feet of Section BB shown in your exhibit 27 was not intended to occupy the first 720 feet after you left the 110 feet of lining in the north tunnel, but was to be scattered throughout the tunnel at any place that it might be required?

A. That is true, if necessary—if necessary.

Q. But isn't it a fact that when you testified you said that it was to keep that first 720 feet of the wall plate drift?

A. If I did, Mr. Tinning, the thought was for estimating purposes.

Q. Isn't it true that this exhibit shows the timbering in the east portal, in the 20-foot range that you referred to, and shows the permanent timbers, which you said were about 40 feet, and also 720 feet to the Wildcat fault?

A. In addition, yes, an additional 720 feet to 60 feet, adding the east and west timber section; that amount of timber I estimated in getting the bids ready.

Q. Isn't it true that this note says, "Shaded areas indicate tunnel sections where permanent timbering was anticipated"?

A. In the estimate, yes, but not in the thought back of the estimate.

Q. Are you going to change from full face to drift as you went through this tunnel?

(Testimony of Lewis Michael Larson.)

A. If necessary. I did not contemplate it would be necessary because Dr. Louderback said it was self-supporting.

Q. If it was not going to be necessary why were you going to require permanent timbers after you left Wilcat fault? [868]

A. As a precautionary measure; I did not say I am going to use them; the way I answered you was, my thought was just as Dr. Louderback stated, I included liner plates, I included the Type B section, but I did not say I intended to use it; it was merely a precautionary measure added to make my estimate safe.

Q. But it is a fact, is it not, if you desired to use permanent timbers or heavy materials, you would have to have some method other than the open face method to drive through? A. If, yes.

Q. If you found them? A. Yes.

Q. And you included that "if" in your estimate, didn't you? A. I don't know that I did.

Q. Mr. Larson, isn't it a fact that you anticipated no change in the method that you proposed in driving this tunnel from the time you left the point at 760 feet past the west portal until you arrived 20 feet from the east portal, you planned to drive a full open section?

A. That is approximately correct, Mr. Tinning, I won't say you are limiting it correctly, 760 feet may not be, but if you subtract 30 per cent. from

(Testimony of Lewis Michael Larson.)

the total length of the tunnel and put it all together in one group, then you have the correct answer.

Q. You say that I did not state it correctly. I am stating exactly what is shown on your diagram and to which you testified, am I not?

A. I believe you are.

Q. So I have stated it correctly.

A. You have stated it correctly as you understood it, yes.

Q. You are now qualifying what was shown on your diagram some week after you testified to it by saying that the shaded area did not represent where you expected to put permanent timbers, but that you expected to put permanent timbers at places where and if it became necessary. That is correct, is not?

A. To a certain [869] extent, yes, it is correct, but I am speaking of my estimate and the grouping for the purpose of making my estimate understandable and simple to people for whom I was working. My thought, as I said before, is that there would be about 70 per cent. of this tunnel in the continuous, without any change being necessary from the full face system, and that the timber that is indicated there is largely precautionary in amount.

Q. Mr. Larson, I wonder if you will look at Exhibit 27 and look at Section CC, full faced cherts 10 feet round, Orindan five feet round, timbering 12

(Testimony of Lewis Michael Larson.)

by 12, set on 5-foot centers, re-used timber three times, total use 4. A. That is correct.

Q. Now, your full faced operation as set up was a case when you passed Wildcat fault and continued until you struck the east portal?

A. Approximately.

Q. And when you were driving through the Monterey Sandstone you were using a wall plate for ground that was heavier than your anticipation, that the cherts required more support, and in that section of 720 feet you were planning to leave all of the timbers, if required, and there is nothing on your diagram that indicates that you proposed to leave any permanent timbering anywhere after you left the Wildcat fault?

A. I did not intend to, except as I testified to in my earlier statement for the purpose of the protection of the men who might be working under, to leave spiling in and carry that spiling down, the piling support down.

Q. We are talking now about the 12 by 12 timbers shown on Section CC, which you were going to use four times, and that was all in the cherts?

A. In the cherts and Orindan.

The Court: We will take a recess now until two o'clock.

(A recess was here taken until two o'clock p. m.)

[870]

(Testimony of Lewis Michael Larson.)

Afternoon Session,
Thursday, April 21, 1938,
2:00 o'Clock P. M.

LEWIS MICHAEL LARSON,

Cross Examination (continued)

Mr. Tinning: Q. Mr. Larson, in preparing your estimate, did you have in mind the provisions of the certain paragraph on page 16 of Dr. Louderback's report, in which he says:

"Based on experience gained from other tunnels in the cherts, and judging from long exposed steep quarry faces in the same formation, it may be expected that after driving, and after the material in the immediate vicinity of the tunnel has come to equilibrium, the rock will stand well and need no support"?

A. I knew of that; and I had read that conclusion, and gave it consideration, as I understood the report. In this particular instance, it would refer, in my judgment, more particularly to the faulted zone.

Q. Well, the Doctor refers to the faulted zone, in the next sentence of the paragraph, doesn't he?

A. He refers to the faulted zone, in the next sentence.

Q. But you took the preceding sentence, then, in your consideration, as referring only to the faulted zone?

(Testimony of Lewis Michael Larson.)

A. The reason of my doing that, Mr. Tinning—

Q. Well, will you answer "Yes" or "No," and then explain?

A. May I have the question repeated?

(Pending question read by the reporter.)

The Witness: A. Yes, chiefly.

Mr. Tinning: Q. Then, the following, or third, sentence in the paragraph:

"Even the part in the fault zone is likely to stand well after the driving through it is completed. This was the experience in the [871] Claremont Tunnel."

Do you still believe the first sentence refers only to the portions of the tunnel material adjacent to the tunnel in the immediate vicinity of the faulted zone?

A. Yes, I do, in view of his conclusion.

The Court: Just so I may find myself:

Q. You refer repeatedly to "conclusions." What is that?

A. That is on page 18, your Honor.

Q. Under the heading "Tunnel in General"?

A. Yes, "Tunnel in General."

Q. That consists of pages 18 and 19?

A. No. 18, only.

Q. Page 18, only? A. Yes, sir.

Mr. Tinning: 19, your Honor, deals with the outside.

(Testimony of Lewis Michael Larson.)

The Court: Yes. He referred to the conclusions, and I was looking them over; and they are labelled here "Tunnel in General." That is all I wanted. I just wanted to locate what he had in mind. You may proceed.

Mr. Tinning: Q. Now, passing to the "Orinda Formation":

"From about Station 130 (as judged by surface dip, but it may be farther along in the tunnel as the dip may steepen underground), to the east portal of the proposed tunnel, the bore will be entirely in the Orinda formation—This formation consists of a series of alternations of beds of consolidated gravel, clayey sandstone, and sandy clays, which were laid down as fresh water deposits."

When you passed through the drift running from the east portal westerly toward the west in the tunnel, in your inspection made about September of 1935, did you observe the formation that were passed through by these drifts? A. Roughly.

Q. Would you say that they are predicted by Dr. Louderback's report?

A. My conclusion, drawn at that time—it was two or three months, I think, after they were driven—was that the formation was not so [872] firm as the Doctor had intended to convey in his general conclusion.

(Testimony of Lewis Michael Larson.)

Q. Now, Mr. Larson, we are discussing these specific statements made under the heading "The Orinda Formation," on page 16; and particularly directing your attention to the portion thereof which states:

"This formation consists of a series of alternations of beds of consolidated gravel, clayey sandstone, and sandy clays——"

Were the materials described in this paragraph, in general, the type of materials that were penetrated by the drifts referred to in my earlier question?

A. Yes, particularly in this sentence you have just read.

Q. "Tunnel driving is generally rapid in the sandstones and clays, somewhat slower in the gravels, which are naturally harder on drill steel. The formation usually breaks rather blocky and often develops a certain amount of overbreak."

Now, yesterday, in your testimony regarding the Orindan formation in the Claremont Tunnel, I understood you to say that, when you got in the gravels, you found, as Mr. Hulin had predicted, the gravel would be hard on drill steel?

A. That is correct.

Q. In other words, it was harder to drill?

A. Yes.

(Testimony of Lewis Michael Larson.)

Q. From your observation of the material in the Broadway Tunnel, made at the time when you went through those drifts, or any other knowledge that you obtained, would you say that Dr. Louderback's report deviated from what was actually encountered in the Orindan formation?

A. Not as to the method in which the material was laid down, nor the different kinds of material that would be encountered; but I concluded that the firmness that was intended by the remarks of Dr. Louderback on the Orindan formation were not as firm as he intended to convey.

Q. Well, is there any statement in what I have just gone over with [873] you, regarding the Orinda formation and firmness? A. Not yet.

Q. "Water and its Effects." "Water is usually in very slight amount in the Orinda formation, coming in along certain gravels and coarse sands, or seeping along minor faults or shear zones. Most of the formation is likely to be dry."

Did you notice, when you went over those drifts we have been referring to, whether or not there was any considerable quantity of water?

A. I did not see any considerable quantity.

Q. In other words, the Doctor's predictions that these are likely to be dry were pretty well borne out by the facts, weren't they?

A. At the time the trip was made, there was a little mud in the immediate vicinity; but it was

(Testimony of Lewis Michael Larson.)

impossible for me to tell just the source of that, whether that came from drilling with the use of wet jack hammers, or whether it was from any cause, I was unable, at that time, to determine, or at least I did not go to that point; it was not necessary for me to try to determine the source.

Q. Well, there was no considerable quantity of water there? A. Very little of it.

Q. You encountered water in various stations in the Claremont Tunnel, in going through the Orinda, didn't you?

A. In the cemented gravels, we would encounter water, in the Claremont Tunnel; and when we shot the round, there was no evidence at all of water; where the water went to, I am still unable to say; it disappeared entirely.

Q. One of the mysteries of tunnel excavation?

A. One of the mysteries of tunnel excavation.

Q. Would you say the water in the Claremont Tunnel was comparable with that you saw in the Broadway Tunnel, in the Orindan?

A. My recollection, now, Mr. Tinning, is that there was more moisture in these drifts to which you are referring, in the Broadway [874] Tunnel, than we encountered in any portion of the Orindan formation in the Claremont Tunnel.

Q. Well, I will just call your attention to your testimony regarding the swelling ground that you encountered in the Orindan. We went over it yesterday: The Claremont Tunnel, about 500 feet be-

(Testimony of Lewis Michael Larson.)

fore you reached the limestone and the lava— Do you remember that section?

A. I remember that section.

Q. There was plenty of water there?

A. I think there was not one drop.

Q. No drop?

A. I don't think there was one drop in that whole section that you are speaking of. You are speaking of the swelling ground section, now, aren't you?

Q. Yes.

A. I think there was not one drop.

Q. In the Orindan, in the vicinity of the swelling section, wasn't it a fact there was water that dripped out of the opening, after it was excavated, and had to be carried away?

A. Not that I have any recollection of.

Q. What about this stuff that mucked like wool, you said, when it was wet; you said it was resilient?

A. That was in the immediate vicinity of the change of formations, from the Orindan and what we have determined to be the limestone, before we struck a little water there.

Q. Then, it is your testimony that, after you got away from the immediate effect of the fault at the edge of the cherts, when you passed into the Orindan and got into what was the better Orindan, that it was substantially dry?

A. I have no recollection of any water excepting

(Testimony of Lewis Michael Larson.)

what I have enumerated in the conglomerate, which disappeared, as I have stated.

Q. The conglomerate is one of the component parts of that Orindan? A. Yes, it is. [875]

Q. Possibly there was water in that portion of the tunnel?

A. Possibly there was water in that portion of the tunnel when we drilled, or when we shot.

Q. Did you see any gravel in the Broadway Tunnel when you passed through those drifts?

A. I believe I did. My recollection is not too clear on that, but I think I found gravel formation there.

Q. In other words, as you passed through the Orindan you found the typical Orinda formation?

A. I think I did.

Q. Gravel, Orinda, or strata; then——

A. If you leave the water out, yes, because I am not competent to say whether that was present in the formation or not.

Q. Did you consider this:

“While these sandstones and clays are naturally mostly dry, they are generally affected by contact with water. In fact they are sensitive to both drying and wetting, and a chunk removed from underground and exposed above ground usually cracks and slacks in the sun, and breaks down into a soft clay or mud in the rain. While the beds are firm, and when dry stand well underground, they carry but little natural

(Testimony of Lewis Michael Larson.)

cementing material, except in occasional layers. These cemented layers remain firm even on exposure to sun or water."

Did you consider that? A. I did.

Q. Did you consider that it is firm and stands well when protected from water action and air slacking? A. I did.

Q. Did you consider what Dr. Louderback stated in his report, on page 17,—that it was likely, in this Broadway Tunnel, that you would not encounter as much water as you had at the lower elevation of the Claremont Tunnel? A. I noted that.

Q. Did you have in mind, in your proposed method of construction, to set up protection, if you thought you would, during construction, encounter the Orinda formation,—water in the Orinda formation that [876] might come from other parts of the tunnel?

A. I did. We were supposed to be driving from the west end; and it would be difficult for water to come up a 4 per cent grade and come into the Orinda formation even though it was actually present in the cherts or any other formation that lay farther downgrade.

Q. Were the east portal portions of the tunnel excavated in any respect when you left on April 30, 1935?

A. I believe, about 30 feet; I am not sure as to the extent; but, from going through these Company records, it is my conviction that somewhere in the

(Testimony of Lewis Michael Larson.)

vicinity of 30 feet had been excavated in addition to the ground necessary for the erection of the portal building.

Q. Which was not in the tunnel proper; it was an open cut where that building was built?

A. That is true.

Q. Did you observe that area just before you left? A. No; I did not.

Q. You saw it, of course, when you came back at the end of August?

A. Yes, I saw it at that time.

Q. Did you observe the condition, then, at the east portal drift, or the east portal of the tunnel?

A. Rather roughly. My interest lay in the inspection of the drifts rather than the outside. The outside seemed to be secure. I could not tell you what the real conditions were in the open cut.

Q. Could you tell us what the conditions were within, say, approximately 30 feet, on the tunnel ring that you saw was excavated there?

A. Only in this particular: that it seemed to be safe; the timber was holding.

Q. In other words, it was timbered?

A. It was timbered.

Q. And had been, because your impression is there was about 30 feet of excavation there when you left at the end of April—it had been, [877] for three or four months, timbered and left open to slacking effect of the air, or any water, that might get into that pit?

(Testimony of Lewis Michael Larson.)

A. I believe that would be undeniable.

Q. Dr. Louderback's report, as we have just said, particularly calls attention to the desirability of preventing air slacking or water effect on the Orindan?

A. Yes. Of course, I don't know just what degree—what I mean by the time element—how long a period he had in mind.

Q. Referring to the tunnel, in general, when you say that you have made this your cardinal principle, or the basis of your conclusion of what Dr. Louderback meant, did you mean to say that you understood that this applied to the entire length of the tunnel,—the generalization?

A. I think that it refers more particularly to the Orindan and the cherts sections.

Q. As a matter of fact, in the second paragraph of the generalizations, does not Dr. Louderback say:

“Throughout the main belt of cherts, the rocks may be expected to be entirely self-supporting indefinitely; in the fault belt of cherts and in the Orindan, with proper care in driving and handling, the rocks should stand well and be self-supporting except possibly along certain shear zones which may require local reenforcement to withstand local pressure (not general weight).”

I understood you to say that, from reading these paragraphs that make up the generalization, you

(Testimony of Lewis Michael Larson.)

concluded that, through the major portion of the tunnel, the material would stand indefinitely, without any support, against great pressure?

A. I think that is— Yes; I will say, I think that is the importance of that.

Q. That was your interpretation? A. Yes.

Q. In other words, that in a tunnel which, as you examined the plans, called for a permanent lining of reinforced concrete 2 feet [878] in thickness at the crown and 5 feet at the base, you assumed that no permanent support was required to hold up the mass of that mountain above that tunnel?

A. Yes; I assumed that Dr. Louderback had stated that; and, of course, I must qualify that by saying that was not intended for 100 years. My interpretation would be during the construction period. I also say it was a proper construction to line tunnels, whether the rock is self-sustaining or not, with the spillings; and, in addition to that, that you have to be careful. I could not conclude, from the concrete lining, that Dr. Louderback's conclusions were wrong, as I understood them.

Q. Did you conclude that the design was unnecessarily heavy?

A. I gave no thought to that at all. That was not my function.

Q. You gave no consideration to the fact that it appeared on these plans that a lining 5 feet in thickness at the base and 2 feet in thickness at the top, with reinforcing, by the provisions in the specifica-

(Testimony of Lewis Michael Larson.)

tions that permitted the District Engineer to add whatever steel he thought was necessary and pay you your bid price for it; you did not give any consideration that that might be a lining to be placed in this tunnel, which you say you thought was going to be, in the main, self-supporting?

A. Yes; I assumed that that lining would be placed there, because the plan specifically stated it would be; but I did not conclude that had anything to do with the construction feature or the ability of the ground to stand unsupported during the construction period. The other was construction detail, and in the mind of the Engineer; and whatever had influenced him was not my function to try to decipher, nor the amount of reinforcing, nor the amount of concrete, nor the reason therefor; it did not influence me to stop. The conditions were different from those specifications or express statements, as I understood them, in Dr. Louderback's general conclusions. [879] *

Q. Then, as you understood the general conclusions, you eliminated all that had been said before, you eliminated all that had been shown in the plans and specifications, with respect to the thickness of the lining that was to be placed in the tunnel?

A. Yes; with regard to the thickness of the lining that was to be placed in the tunnel, because it, in itself, did not differentiate in any particular location; but I must recall, again, that, in the specifications, there is the requirement for special permission

(Testimony of Lewis Michael Larson.)

to leave the timbers in. If it were there, if it had been placed there for construction purposes, it must be taken out, indicating a conclusion, the same as I had drawn, in Dr. Louderback's report, that, in the main, it would be self-supporting ground, or in construction. That was my interpretation.

Q. You thought the specifications were attempting to predict the conditions that would be encountered in the ground?

A. I thought the specifications were attempting, or were influenced by a thought similar to my own: that the ground would be self-sustaining during construction.

Q. Now, as a matter of fact, this very statement that we have been over, says that, in the fault belt of the cherts and Orindan, with proper care in driving and handling, the rocks should stand well and be self-supporting except possibly along certain shear zones which may require local reenforcement to withstand local pressure, not general weight. You understood from that, did you, that you would, at certain places, expect to find problems that you would have to meet, in driving this tunnel; you would have to support that in some way, as you went through?

A. I did; and I made special provision for that, by timbering it at 5 foot sets all the way through the tunnel, and removing that timber only when the concrete was brought up. [880]

(Testimony of Lewis Michael Larson.)

Q. This statement at the conclusion of the report following the title "Tunnel in General" is what you base your statement upon, or what you based your assumption upon that you would find throughout the tunnel the majority of the tunnel rock which required no substantial support in construction? A. That is correct.

Q. Mr. Larson, as an engineer expert, you keep familiar with the construction projects you stated and read the Western Construction News and other publications? A. I endeavored to.

Q. Did you read this article that appeared in the Western Construction News and Highway Builder of July, 1933, reading from page 318:

"Both tunnel sections will be 35 feet out to out in excavation and 34 feet high. A reinforced concrete lining will be placed throughout, varying from 2 feet thick at the crown of the arch to 5 feet at the haunch. The tunnel is expected to require support for practically the entire length of each bore and the contractor will be allowed to place either timber sets and lagging or steel ribs and liner plates back of the concrete. Where practicable, the upper part of the arch is to be poured last so as to key the tunnel structure. Concrete specifications are based upon cement content and slump.

"Tunnel muck is classified as Monterey sandstone for the first 600-700 feet from the west portal, Claremont cherts for 1200 feet, and

(Testimony of Lewis Michael Larson.)

Orindan formation for the remaining distance.

A geological report on the tunnel has been prepared by George D. Louderback, consulting geologist, and will be available for inspection at the office of the District Engineer."

Did you see that article?

A. Not until within the last two weeks.

Q. So that at the time you did not have it in mind?

A. I did not have it in mind. If I had had it in mind I would wonder why Dr. Louderback had apparently disregarded that, if he thought it [881] worthy of giving consideration to, because the conclusion here must be very different from what you have just read.

Q. Of course, this article was published with respect to the geological report that you have there.

A. I could not know the source of the information.

Mr. Tinning: We will offer this article in evidence.

Mr. Marrin: For what purpose?

Mr. Tinning: For the purpose of expert knowledge or lack of knowledge.

Mr. Marrin: We object to that as immaterial, irrelevant, and incompetent. The witness has testified that he did not know anything about it prior to the time the bid was placed; we object to it further as being pure hearsay.

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: Will you stipulate that the Bechtal Company was a subscriber to the Western Construction News?

Mr. Marrin: I could not, because I don't know whether they were, or not.

Mr. Wittschen: We will prove that.

Mr. Marrin: It is a hearsay statement.

Mr. Alexander: The same objection.

Mr. Marrin: It does not show the source of the information, it is the rankest kind of hearsay; We object to its introduction.

The Court: The Court will sustain an objection at this time.

Mr. Tinning: Exception.

Q. You testified here last week with respect to the method that you adopted in going underground in this tunnel, that the method shown on the model which has been introduced here as Plaintiff's Exhibit No. 28 was what you purposed using in getting under what you assumed at that time would be 40 feet at the west portal.

A. With certain exceptions, Mr. Tinning. I had not planned to [882] make the lower drift as large. I had planned on making the other drifts larger. This exhibit here is the result of a condition that was found that forced me to adopt this particular design.

Q. Then perhaps I did not understand your testimony. Then Plaintiff's Exhibit No. 28 represents the manner in which you actually drove?

(Testimony of Lewis Michael Larson.)

A. The manner in which I actually drove, and approximated the manner that I contemplated driving.

Q. And Plaintiff's Exhibit 27, Section AA, is a diagram of what you proposed?

A. What I proposed.

Q. Now, I believe you stated that when you got into this problem, actually working it out, you found it necessary to go into a 13 drift operation?

A. That is true.

Q. Does this model show a 13-drift operation?

A. It is lacking in the fact that the posts have been removed, that bring out clearly the drifts, but the segments, if you will count the segments they will show you that there are 13 drifts present.

The Court: Indicate that so that I may follow you.

A. These, your Honor, are posts and segments, and when I refer to the number that would make up 13 drifts, and some of the information is wanting in driving a drift, we have posts at the contact of the segment timbers carrying down to the core. Those have not been introduced in this particular model.

Q. I understand, but how do you make up your 13?

A. Here would be 1, 2, 3, 4, 5, and 6; the top drift would be 7, and then there are six on the other side, making a total of 13.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Q. Mr. Larson, just a moment, please, while you are on your feet. A drift is indicated on this model by perpendicular posts and a cap?

A. Correct.

Q. And is it not a fact that in driving this tunnel you went up with four drifts on each side, as indicated in the model, to [883] the point that I am pointing to at about the point opposite where the core is shown on this model?

A. I went up with four drifts to this point, yes.

Q. Each one of these drifts has a cap upon it, as shown here, posts on the outside, and posts in the interior with lagging against the core; that is correct, is it not?

A. If the testimony is to be technical I shall have to say that after you reach the spring line then we term them segments instead of posts.

Q. But to answer the question specifically, you have in a drift an enclosure on three sides, the top and the two sides that are either perpendicular or angular to meet the design of the tunnel outline up to and including the fourth drift? A. Yes.

Q. Isn't it a fact that in your excavation of both the south and north tunnels the distance of your first operation, that you took out a ring between the top of the fourth drift, all in one operation?

A. That is not a fact.

Q. Isn't it a fact that each segment was placed and held a timber studded against the core, and that

(Testimony of Lewis Michael Larson.)

this material was not taken out by driving ahead under one segment, but was taken out as a complete operation at the face of the tunnel on the top of the core?

A. Generally, that is not the fact. Generally, these drifts were advanced as individual drifts. There might have been a very few exceptions where the material was stiff enough that I could carry possibly three of these drifts parallel, but that is the exception, and not the rule.

Q. Isn't it a fact that these timbers were carried up, that segment timbers were carried up by excavation into the face and held up and studded against the top of the timber, which was a cap of the fourth drift, and then the next segment toward the center, or next to the crown, were carried up and studded likewise against the cap?

A. I think this one, here, was carried to the core. That [884] is my recollection.

Q. Will you look at the model near the part that indicates the unexcavated ground and see if those timbers which show on the last ring at the top do not indicate the way in which that was supported?

A. It indicates the support at this point, which is a segment, which is carried down to this cap.

Q. What is this section?

A. In this particular case it would be E section.

Q. The E segment? A. The E segment.

Q. What was the distance between the bottom of the E segment and the top of the cap of the fourth drift?

(Testimony of Lewis Michael Larson.)

A. I cannot recall it now, I should say probably four feet.

Q. And would you say that that was drifted out and was not taken out by the surface by one operation across the face?

A. I am very sure in the major portion of the tunnel that that was not the case; there might have been exceptions to that.

Q. We are just talking about going underground in the 110 feet of the north tunnel and 92 feet in the other tunnel.

A. Yes, I am trying to make the explanation here that to the best of my recollection that was not the case in general.

Q. You do not think that that crown was stoped out?

A. It was stoped out after you reached the lower drift, the material then was dropped into the drift below.

Q. Isn't it a fact that it was taken out as one operation and that the only timbers you had, you had no lagging in this crown, were timbers holding up your sides as you put them in?

A. No, that could not be true. If I understand you correctly in this case—do you mean that I was dumping the material over the face of the core?

Q. No, I assume you would be dumping the material as it was stoped [885] out from the entire ring above four feet into the third drift.

(Testimony of Lewis Michael Larson.)

A. Yes, that is what I was doing, and carrying it up to the lower drift, getting the support from this segment down to the core.

Q. But there was no lagging, there was no partition, there were no caps, and there were no interior walls in the drift, as you have shown, in drifts 1, 2, 3, and 4? A. Not in this one here?

Q. Yes.

A. It is my best recollection that this post that carried down to the cap of No. 4 had lagging against to prevent this material from falling in.

Q. Are you depending on your recollection?

A. I am depending on my recollection.

Q. I will show you Plaintiff's Exhibit No. 40, which appears to be a photograph of the west portal face from the right side of the center line, August 10, 1934—I am not trying to confuse you, but I understood your testimony to be that these two drifts later became part of the Drift No. 1, one in the left tunnel and one in the right tunnel.

A. No, that is a misstatement, Mr. Tinning. They were driven in at that time with a view to trying to carry on the excavation by this to the right and this to the left of the attempted drift.

Q. In other words, these two drifts that are here shown were actually on the center line of the tunnel?

A. As nearly as we could make them.

Q. And when you went underground, in starting, I think you said, about August 23rd? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. You placed one drift that would be the right-hand drift to the right of this attempted drift?

A. Yes.

Q. And another one to the left? A. Yes.

Q. And when you started on the north tunnel you likewise show the drift in here and a drift—when I say “here,” to the right? A. Yes. [886]

Q. Of the original parallel drift and again another one to the left?

A. Yes; to make it clear to you, I first made an attempt to go in that way on account of other work that was going on in advancing that interior, and my recollection is, and I believe it is true, that by the time that I got to going in on the first one, that that was obliterated entirely, that that was no longer there.

Q. That is your general impression of the situation?

A. It is my general impression, and I think it is pretty clear on that.

Q. Now, these drifts numbered 1 right and left, the bottom drift on each side, when you went underground were twelve feet wide each, weren't they?

A. Approximately.

Q. And then you gradually narrowed those down as you went underground and when you were 10 or 20 feet underground you cut them down to 10-foot drifts?

A. I do not believe, Mr. Tinning, that there was any difference in the width of those drifts during

(Testimony of Lewis Michael Larson.)

the whole course of the 92 feet and 110 feet. I have no recollection of crimping it. My reason for mak-ing them as wide as they were—let me explain that, it will make it clear—we had four-yard cars, that would hold four yards of material, and on them we put sides to increase the capacity, and that was a definite width; we could not vary to the point where we could not get those cars into the drift; the drift, to begin with, as I recall, was sufficiently wide and no wider than was necessary to allow free movement of the cars. It might be—my recollection is not clear on that—that when I found I could go in there a few yards, I might have taken advantage of it on account of the terrific weight of the ground.

Q. Isn't it a fact that your drifts started in 12 feet and were cut down to 10 feet, and the reason was you had to cut a core in, you had to switch something to key to that line, and you had [887] to have a little extra room to get around the curve into the drift?

A. You are refreshing my memory on that. I remember what the obstruction was now and I will explain it. Right in here was an obstruction—

Q. By "here" you are referring to the north tunnel?

A. On the north tunnel, and in order to get past that obstruction I did have to slice off a little more of the core. I had forgotten that.

Q. Mr. Larson, I am going to show you a series of diagrams which I think depict the actual position

(Testimony of Lewis Michael Larson.)

and the measurement of every timber that went into each of these tunnels in your initial operation.

Mr. Smith: What have you got there, diagrams of the whole 110 feet?

Mr. Tinning: This happens to be the upgrade tunnel, the south tunnel, so it is 92 feet.

Q. I show you some diagrams showing the south tunnel of the west portal.

A. Let me ask you this question, is this the first set that carried no weight?

Q. That is the first set, and I think it would be indicated, I think you will find the portion I am pointing to here.

A. There was a particular reason for my asking that. Apparently the cap on this, this cap, here, is standing entirely on a scab that is held by nails. I would be inclined to challenge that part without having any way of definitely proving I am right, but I am very sure that the weight of the material would forbid the use of that.

Q. Mr. Larson, if you will look at the model you will see you have got a scab on your model.

A. Yes, the scab I think carries down to the footblock there, but you will notice on this one you [888] are not carrying it to the footblock; you are depending entirely on nails that project up above this cap, and carries the weight of the whole cap, and nothing but nails, which makes me question it.

Q. That makes you question it? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. These are measurements that were taken there and of course I was not there, but we will note this exception.

A. Yes, I think there is a mistake there.

Mr. Smith: Which one are you referring to?

Mr. Tinning: We will have to take these by numbers. These diagrams were made at the time from measurements that Mr. Ray, a District employee, took from day to day. You feel that the diagram appearing on page 1, which shows it is in a scab nailed onto a 12 by 12, on that north side of the original center drift is in error because it shows that it must have been nailed against another piece of timber and would not sustain the weight?

A. There is another omission. There is nothing across the top here that we term a scab to prevent that cap from falling off from this support, here, and falling into the tunnel. So I think something has been overlooked.

Q. At that point there was no material on top of this, it was simply a platform to hold the lagging for what afterwards became another drift?

A. Or more accurately stated probably an incom-
pleted set.

Q. What do you mean by incompleated set?

A. The work on the set had not been completed to the stage where the set, itself, was complete.

Q. That is your judgment?

A. That is my judgment, it is so obvious.

Mr. Smith: Does that bear a date?

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Yes, September 16, 1934. [889]

Q. I will now show you page 2, bearing date the 23rd of September, 1934. You will notice that on each of these diagrams there is a statement of the station and the date that the set was placed, and I understand that the measurements were taken immediately following.

A. I see another error here. I am not afraid to challenge this one. These posts against the core in the second drift were of a length whereby the cap rested on the post, not on a scab on this set, but was resting on a scab on this set. And another thing is this, here, may be a support for a shore that ran to the building, but if it is not, then there is an error there, because this post was divided at this line, here—pardon my writing on that.

Q. I think it would be better not to write on it, because they are original records. What you describe is this post, here, above the 12 by 12 plate on the left-hand side of the picture?

A. I do not think his Honor can see this. The point I am making is this, this post was an independent post sawed off at the top of this cap.

Q. Let me get that for the record. This post is a vertical post running from the top of the first drift on the interior right against the core vertically, as shown on here, through drift No. 2 and drift No. 3 to the bottom of the cap of drift No. 3. You say that should be two posts and that the cap of drift No. 1 should extend through?

A. Let me illustrate.

(Testimony of Lewis Michael Larson.)

Q. Will you answer my question? A. Yes.

Q. On the other side of the drifts, of these two upper drifts, 2 and 3, instead of being shown as one continuous post, running over to the wall plate on the left drift, to the wall plate at the top of No. 3 drift, that that should also be two posts?

A. And a wall plate in between. [890]

Q. The wall plate in between?

A. Yes, and this member here——

Q. That is the cap of drift No. 2?

A. Yes, was heavier than 3 by 8, and I am confident this shows two 3 by 8s, if that is intended for the post, and I doubt that Mr. Ray had that in mind. I am inclined to think he picked up the support for the stull that runs to the portal building, and I would suggest that you bring that to his attention, because I think he has—that this cap carried over this post and this post set on that cap, and this cap rested on this scab, but in this post here was another wall plate, and that was uniform in the drift on each side.

Q. Those are your suggestions with respect to Sheet 2? A. Yes.

Q. I will hand you now sheet 3, showing a section at 111 plus 72; that would be 5 feet farther into the tunnel than the section shown on sheet 2.

A. This is typical of what I was trying to show over here.

Q. The witness is now pointing to the right-hand drift on sheet No. 3 and stating that the drawing

(Testimony of Lewis Michael Larson.)

there typifies what he says should appear on the left-hand side of sheet No. 2. You will note that Sheet No. 3 shows the left-hand drift in the same manner as you stated was in error. A. Yes.

Q. The same thing applies to it? A. Yes.

Q. And you still think that is an error?

A. I am very confident that is an error.

Q. Now, we go in another four feet on sheet No. 4.

A. Now we are in 8 feet from the first set, as I understand it. The first one is outside.

Q. The first is 111 plus 62 and this is 111 plus 76, that is 14 feet? A. Yes.

Q. And there have been sets intervening from the first set? [891] A. Yes.

Q. This is the fourth set? A. Yes.

Q. 60 feet in? A. Yes. This is typical.

Q. So you have no objection to the general typification of the method which he used?

A. There is only one thing lacking that I should call attention to at this point, the same problem here, there was nothing to keep this post from kicking in from the weight of the core in each instance; a section should be shown in there to hold the other.

Q. When you say "this post" you are referring to the vertical post against the core on the drift on both sides of the tunnel? A. Yes.

Q. Does your model show any scab?

A. I imagine it does, I have not checked it over.

(Testimony of Lewis Michael Larson.)

Q. The next one is approximately four feet further in to the mountain and it shows the post set in the fourth drift on the north or left-hand side of the upgrade tunnel; there seems to be no change in the type of construction on the other side.

A. In carrying up your sets we have not got into the drift on the right-hand side. I want to make the same remarks that the scab has been left off in each instance to keep the post from kicking in.

The Court: On both sides? A. Yes.

Mr. Tinning: Q. In every instance, nowhere in these drawings so far does it show that there is any scab or something similar to a collar brace in the opposite direction between the outside of the permanent timbers and the interior timbers, vertical timbers that are against the core?

A. There are other things lacking that are not intended to be carried in here—you have no collar braces.

Q. You cannot show collar braces very well on a vertical? [892]

A. Yes, it could be shown, but it is not material unless attention is called to the fact that they were.

Q. There is nothing shown that does not pass through the section, and of course the collar braces do not pass through?

A. No, the collar braces would rest on top and underneath the wall plate and run from post to post.

Q. Longitudinal braces? A. Yes.

(Testimony of Lewis Michael Larson.)

Q. Now, we come to another four feet, and we find the same situation, with your four drifts on each side, subject to the same exception that you have taken to the photograph of scabs. Now, on page 8 we have another four feet, five feet this time, from 87 to 92, and you will notice we have spiling on top of your fourth drift and you have vertical timbers running from the core to the end of the segments shown very much as they are shown in the model? A. Yes.

Q. You have testified that each of these was run, each of the places in the crown above the fourth drift was run as a separate set, and taking them together, one, two, three, four, and five drifts, that is how you get your thirteen drifts you said you had?

A. I believe in substance that is correct.

Q. But it is true, is it not, that there was no spiling or lagging on these timbers, that supported the ring section and that those were 4 by 12 timbers that were placed under the end of the segments as they were placed in, with the exception of the cap, which was dropped into place against two 3 by 12 longitudinal timbers?

A. Wall plates—you are not attempting here to show any of the outside supports other than the segments?

Q. The sets, themselves.

A. That would be true in part of the tunnel, but I do not believe it is typical of the whole of the excavation. [893]

(Testimony of Lewis Michael Larson.)

Mr. Wittschen: What we are leading up to,—so there won't be any confusion—the purpose of leading up to this was to show these were not true wall plate drifts.

Mr. Tinning: Q. Looking at 58, you say that is illustrative of the conditions, but you don't believe it is typical of—

A. You get the 4 feet—4 feet apart. These were 4 feet apart.

Q. Sheet No. 9, you see the same condition. Sheet No. 10, you see the same condition depicted; again, Sheet 11, the same condition depicted. Coming to Sheet 12, the same condition depicted. Coming to Sheet 13, 112 plus 12, you see the same condition depicted. At 112 plus 16, on Sheet 14, you see the same condition. At Sheet 15, on the next set, the same condition. Sheet 16, the same condition depicted. Sheet 17, the same condition depicted. Sheet 18, the same condition depicted. Sheet 19, the same condition depicted. Sheet 20, the same condition; and at Station 112 plus 44, the same condition, again. That is the end of your 92-foot excavation, with this drift method; that is 21.

We will offer the diagrams that have been shown to Mr. Larson, as Defendant's Exhibit "J," consisting of 21 original sheets; and, gentlemen, if we would like the privilege of substituting copies at some time in the proceeding, we will be glad to leave these here, but we would not want them to remain.

(Testimony of Lewis Michael Larson.)

Mr. Marrin: Yes; no objection to that. Of course, as these have not been identified by the man who made them, I suppose the witness who made them will be available?

Mr. Tinning: He is available at any time you desire him.

Mr. Smith: Was that only one exhibit?

Mr. Tinning: One exhibit.

Mr. Smith: What is the number?

Mr. Tinning: Exhibit "J." [894]

Mr. Smith: Can we withdraw them overnight, if we desire to do so?

The Court: You may take it up with counsel; I don't think you will have any difficulty.

(The sheets were marked "Defendant's Exhibit J.")

Mr. Tinning: Q. Now, on the downgrade tunnel, I show you some sheets, Mr. Larson—and, by "downgrade tunnel," we refer to the north tunnel?

A. Yes, I understand.

Q. The situation is similar with respect to the diagrams: Diagram No. 1 shows the first set of timbers. It seems to be subject to somewhat the same exceptions. You will notice the cap runs completely through?

A. Yes; and the one thing omitted is the scab that keeps it from——

Q. If you will look at your own model down here, you will see that, in some places, you have scabs; and in other places, you do not?

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estimony of Lewis Michael Larson.)

A. Yes, that is true. I overlooked that important
n, myself.

Mr. Marrin: I might say we did not introduce
model as portraying any particular timber that
s put in.

Mr. Tinning: I understand.

Mr. Wittschen: It was supposed to have all that
a have in there, though; it was demonstrative of
the timbers used, but not in any one place.

Mr. Tinning: I don't think whether there was a
b or anything else in any particular place is any-
ing except for Mr. Larson's own satisfaction with
pect to the accuracy of these diagrams. These
grams are offered for the purpose of showing
t there were not 13 drifts; that there were 9
fts, going underground.

The Court: The details won't make very much
ference, for the purpose of the offer. It only has
do with what actually was there. [895]

Mr. Tinning: That is right; that is the purpose
these diagrams.

Now, I don't know whether it is necessary to go
rough these in detail; it may satisfy you more as
their accuracy; but, turning over until we come
a 4-drift operation, you will notice at no place is
ere any spiling or lagging showing against the
re; it is the set,—the timber structure,—that gives
n the integrity and strength of your timber sup-
rt. We go over to Sheet 6, and we find the same
uation that was depicted on the other diagram, by

(Testimony of Lewis Michael Larson.)

you; and the core is not even sketched in. Here is your ring segment above the fourth drift, on each side being supported by 4 by 12 timbers, 4 feet 8 inches long, and running around the entire circle of the arch, above the fourth drift. Would you say that substantially shows the condition, as it existed in the tunnel at that point,—Station 111 plus 72?

A. I think there are exceptions to that, that I should note here: In the first place, I don't think there was a uniform use of the size of timbers. My recollection is that that would vary all the way from 8 by 8's, possibly 6 by 6's, and 10 by 10's. The point I am bringing out: this is not a real true illustration, because I have learned, in the last few days, that I had to be very careful.

Q. Let's take Sheet 6, on the north tunnel, where you will see a 6 by 6, two timbers away from the one you pointed out?

A. Yes; but this is not a 6 by 6 here.

Q. Well, I am showing you one, two sticks away from the one you pointed out,—the same kind you called a 6 by 6?

A. Yes; but I still believe there were 6 by 6's, 8 by 8's, and 10 by 10's, at this point.

Q. That may be true. You find, on your next diagram, that you have here, 6 by 6's forming the stulls from the cap on the fourth drift, on each side of the tunnel. You find that again, 6 by 12. [896] You have that, also,—heavier timber, on Sheet 8, being shown there; and on Sheet 9, 6 by 12; 6 by 12 in the same

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testimony of Lewis Michael Larson.)

tion; and we come over to Sheet 10, and you find the same thing; and on Sheet 11, the same thing. Our center is held by 4 by 12's; and the top of the top of the fourth drift, 6 by 12. Doesn't that demonstrate to you, Mr. Larson, that those sections above the fourth drift were not, for instance, stoped out in an operation such as I described to you in the other bunch?

A. It does not. I believe we can upset the statement on that, by overwhelming evidence.

Mr. Tinning: We will offer the diagrams in evidence.

(The 12 sheets were marked "Defendant's Exhibit K.")

The Court: We will take a recess.

(Recess)

Mr. Tinning: Q. Mr. Larson, looking at Plaintiff's Exhibit No. 29, I would like to ask you if it is not true that, in proper, careful timbering, the logs and timbers should be set, as they are shown on this model, so that the timbered section as a unit is vertical? A. Vertical; this way.

Q. Yes. It sets in a vertical plane?

A. That was the determination of the District Engineer when the question came up whether it should be a right angle to the grade of the tunnel or whether it should be vertical; and the determination was that it should be vertical.

(Testimony of Lewis Michael Larson.)

Q. Vertical. Well, at any rate, a timber structure, such as a ring, as shown on this model, to have its maximum strength, should be placed in a vertical position, should it not, so the weight is transmitted through it?

A. That it has strongest resistance in a vertical position, I believe, is generally accepted.

Q. And the joint between the so-called plumb posts and the segment should be so cut that, when the timber is installed, you get a full [897] bearing between the two pieces of timber and that joint?

A. The best authority for that,—the Railroad Companies—the first people to go into the tunnel business to any great extent, found it good practice to have the back of the segment open, this way, so that the weight, when the weight came, it would close. If you make it tight, as my hands are, when your weight comes and it spreads like this, then this part of the segment will split off.

Q. When the timber takes the weight for which it is designed, then the joint comes together?

A. That is the theory.

Q. And to obtain the maximum strength, the joint should have full bearing?

A. That is the theory: it should have, yes, if that is possible.

Q. And the timbers which are placed so that they would not follow through a vertical plane, for instance, say, the top of this section which I have my hand upon, this ring were half an inch toward

(Testimony of Lewis Michael Larson.)

me, so that the top, or crown piece, was not in the same vertical plane as the plumb post, would not be a timber, or timbers, that had the same strength as ones which were properly placed?

A. That is obvious.

Q. During the time you were constructing the tunnels, Mr. Larson, you stated already that Dr. Louderback was frequently in the tunnel. Did you see him, during the time you were employed by the Six Companies, after August 29, 1935?

A. After August 29, 1935?

Q. That was when you came back—

A. Yes; I am trying to recall. I think I saw him either August 29th or August 30th; I am not sure as to the exact date, but it was about the 29th.

Q. Where did you see him?

A. I saw him up at the Old Tunnel Road.

Q. Did you have any conversation with him at that time? A. I did.

Q. Did you tell him, at that time, that you thought the conditions encountered were different from those you expected, or that you [898] anticipated, from his report?

A. I have no recollection of having discussed that phase of it at all.

Q. Did you tell him that you thought that the published attack made by Six Companies on his geological report was unfair and unfounded, and that you thought the conditions that you had en-

(Testimony of Lewis Michael Larson.)

countered in the tunnel were fairly predicted by his report?

A. I have absolutely no recollection of that; and I believe that is not a fact.

Q. When you were working in the tunnels, and prior to the time that you left on April 30th, in any of the conferences that you had with Dr. Louderback at the tunnel, did you tell him that the estimate that you had made for Six Companies had been cut down by Mr. S. D. Bechtel from \$180,000 to \$200,000—an amount somewhere in that neighborhood—between 180,000 and 200,000—because Mr. Bechtel said he had a sentimental reason for wanting to put in a bid that would get the job?

A. I have no recollection of having talked to Dr. Louderback on the estimate in any particular.

Q. Did you make that remark to anyone, at any time?

A. That remark was brought up to me by someone, and I don't know how far the remark was carried. I do believe that I admitted that Mr. Bechtel had said that his father had wished to drive the tunnel, and that there was a sentimental feeling regarding that particular job.

Q. How much was your estimate cut down, by Mr. Bechtel's bid?

A. I believe, later investigation shows only a very, very minor amount. That is what I think the attorneys wished to introduce over your objection.

(Testimony of Lewis Michael Larson.)

Q. How much was it cut down, in your opinion, at the time that the bid was submitted?

A. I am not prepared to say that I knew, at the time that the bid was submitted, that the estimate itself had [899] been cut at all.

Q. You knew it before you left the Company on April 30th, didn't you?

A. Only, I heard these rumors from different sources; and I am not prepared now to say definitely who carried me that information; but there is no evidence, now, nor was there any evidence at that time, that my bid price had been substantially reduced,—that is, nothing tangible.

Q. Did you ever say it to anyone?

A. Not that I recall directly. I know the question was brought up to me, and I discussed it.

Q. Did you ever say it indirectly?

A. Not that I have any knowledge of; not that I have any recollection, at the present time.

Q. Now, you testified, at length, last week, concerning your difficulties in placing concrete in the west portal excavation,—92 feet on one side; and the other, 110 feet. You knew, at the time that you made this bid, or this estimate, that, under the specifications, unless you could place concrete continuously, it was to be placed—where the operation was not continuous, it would have to be placed in one-foot layers; you knew that?

A. I believe—Let me qualify that. I am not sure that I do know that. I believe the specifications say

(Testimony of Lewis Michael Larson.)

that it can be placed in six-foot layers. I might be in error on that. I am not making that as a definite statement; but we will let it stand that it was one foot, for your purpose.

Q. One-foot layers. You stated that the Hackley Gun was selected by you because you knew it was the only approved method at the time; although you knew of the Pumpcrete, you did not feel it had been a tested method by which you cared to try to operate in placing the concrete in this tunnel?

A. I wish to qualify that. I won't say the "only approved method"; but the best and most approved. [900]

Q. Most approved. What were some of the other methods that might have been used?

A. By hand would be one. I don't know whether there would be but the two, right now; I cannot recall except Pneumatic and Hand Placing.

Q. Well, there are other Pneumatic methods, aren't there? A. Yes.

Q. That have been used for 25 years, besides the Pneumatic Gun?

A. Yes; they are numerous; but the principal is identical.

Q. And, of the Pneumatic methods, you have in mind the Hackley Gun was the best?

A. Well, I wouldn't say it was the best; but I was familiar with it. I had placed many thousands of yards with the Hackley Gun.

(Testimony of Lewis Michael Larson.)

Q. Did you ever have a wooden baffle box at any other place when you used the Hackley Gun, other than this Broadway Tunnel?

A. Not that I have any recollection of. There was never a call for it.

Q. You used a steel baffle box in other places, didn't you?

A. I can't recall that I did; I don't believe I did.

Q. Do you know how it was placed in the Sunset Tunnel, where the Hackley Gun was used?

A. No.

Q. You do not know, then, there was a steel baffle box used there, which was of a size that would go between two circles of reinforcing steel,—one on the interior of the arch, and the other at the exterior?

A. I do not. I merely know that Mr. Hackley, who had placed the concrete in the Sunset Tunnel, was chiefly responsible for the suggestion of the method of placing it, and the baffle box idea that we tried out in the Broadway Tunnel.

Q. That baffle box gave you lots of trouble, didn't it? A. A tremendous lot.

Q. It was shattered by the force of the violent inflow of the concrete as it was shot up into the arch? A. Yes. [901]

Q. Into the forms? A. And plugged.

Q. In other words, the material segregated, did it not, and the finest separated out and plugged, and

(Testimony of Lewis Michael Larson.)

the rock went on down; isn't that what you found when you had to clear the plugged lines?

A. Not to the extent that you have described it, Mr. Tinning. I cannot recall, right now, that I found any segregation, on account of the fact that it developed, at the time that I uncovered the plugged line; but I do know, upon placing Pneumatic concrete, there is a tendency for the heavier particles to travel more rapidly than the lighter particles, with a logical result that a certain amount of segregation occurs, in the use of Pneumatic Guns.

Q. That does not give you as good concrete as where you could place a uniform mixture?

A. I think that the Pumpcrete,—if that is what you are driving at,—is much better.

Q. I am not driving at anything, Mr. Larson. I am asking you a question.

A. The uniform mixture is a desirable thing; but I will say this: that we accomplished that very uniformity of mixture in the Claremont Tunnel by shooting the fresh concrete into the concrete then placed; we had a uniform slope there, and shot our first concrete into the old concrete, and it was beautiful concrete as it flowed down the side.

Q. You could not use that method in this tunnel, in the specifications, because you had to place concrete in vertical layers?

A. That was the handicap.

(Testimony of Lewis Michael Larson.)

Q. The reason for that was to make a radial joint, was it not, for the arch?

A. Well, the original specification was: the walls were to be poured up to a certain point, not closer than 2 feet, if I remember that correctly, where they must be keyed; and then, I believe, 7 days later, the arch,—the keyed position,—was to be poured. [902]

Q. Providing it was not poured as a continuous process?

A. Well, this provision was an agreement, between Mr. Boggs and myself, in advance of the estimate, that he would voice no objection to it as—

Q. Well, there was nothing in the specifications to prevent it, was there?

A. I don't know, positively. There may be a positive statement in the specifications on that. My memory is not clear. [903]

Q. In going underground and placing your concrete in these two ring sections, you made in your testimony considerable objection or voiced considerable problems arising from the fact that you had to place your concrete between two sets of reinforcing steel inside of the frames. You said that that caused you additional difficulties?

A. It surely did.

Q. You understood and were told before that the engineer had certain flexibility possible under

(Testimony of Lewis Michael Larson.)

his plans and that he could put additional steel into the sections when in his judgment it was required?

A. That was my belief and understanding.

Q. And that is what was done, too, in the tunnel?

A. That is what was done.

Q. And you had considerable pressures in these rings, did you not, at the mouth?

A. How is that?

Q. You had considerable pressures, you have told us how the stulls bedded into the core and how you had great difficulty holding timbers?

A. Yes.

Q. And how you ran stulls out to the concrete walls at the bottom of the set to hold those timbers in shape so that you could pour and not lose the whole thing?

A. That spiling, let me qualify that, was during the excavation period and stulls to the core was during the excavation and concrete period both.

Q. You had trouble holding the ground, there was extreme pressure in that loose material, that creep and hill wash?

A. Whatever the material was there was a considerable pressure.

Q. So that the District Engineer, in ordering additional steel and additional reinforcing, as he had a right to do under the specifications, was meeting a condition that actually existed?

A. He was, and we did not quarrel about it.

(Testimony of Lewis Michael Larson.)

Q. You found that your baffle box caused slowness in your operation? [904]

A. I did, Mr. Tinning, but the point I would like to bring out in this particular case, at the time we installed the concrete placing unit, I drew a logical conclusion, I think logical, that we could pour one wall at a time; you had two walls that were separated there by probably 25 feet, and I think I remarked at the time that by pouring one wall here and one wall there, if you object to pouring into walls one at a time, why shouldn't you object to pouring in two walls of the portal building at the same time? In this particular place I could not get the point over; I was prepared to pour the one wall at a time and avoid a good deal of this trouble, but that was objected to.

Q. You were not permitted to do it in the south bore?

A. In the south bore, no, but permitted to do it in the north bore.

Q. You had two Hackley guns at the north bore, didn't you?

A. Not mountable, as I recall. I may be mistaken in that.

Q. Isn't it a fact that when you poured the north bore you had two Hackley guns on the job, and you poured one wall from one Hackley gun and the other wall from the other?

A. You may be right. I won't quarrel with you on that.

(Testimony of Lewis Michael Larson.)

Q. You also had difficulty getting concrete mix into your Hackley gun as fast as you could place it with your Hackley gun at times?

A. I believe you are right, though I am not sure of that. I have forgotten the detail.

Q. It was about the first of October that you started to pour this concrete?

A. Approximately.

Q. Well, roughly, the first of October?

A. It was in October, yes.

Q. What concrete plant did the Six Companies have on the job at the time you started to pour these rings?

A. A rented one of K. E. Parker Company.

[905]

Q. The mixer that you used was the same mixer that K. E. Parker used in constructing the building, was it not? A. Yes.

Q. That was the same mixer, a $\frac{3}{4}$ yard mixer?

A. I have forgotten the capacity. We will let it stand at $\frac{3}{4}$ of a yard.

Q. You found as you were using that mixer that there was difficulty and delay in getting enough material to keep your Hackley gun going?

A. Probably in the north tunnel, but I think we had ample time in the south tunnel.

Q. That is your recollection?

A. That is my recollection.

Q. Then why did you rent or take over the use of the Bohnet mixer, a $\frac{1}{2}$ yard mixer, while you

(Testimony of Lewis Michael Larson.)

were pouring the south tunnel, adding capacity to the one you were renting to Parker?

A. I do not remember having done that, but if we did do it, undoubtedly it was the fact that that would not be able to supply it as fast as we could place it, but we apparently had ample time, because, if my memory is correct, we had an hour and a half between pouring one side and then pouring the other side.

Q. It is true, is it not, that you had a number of trials of different methods of getting the pipe up from the Hackley gun to the baffle box in the forms?

A. I do not recall any trouble of getting the pipe up, but I do remember the problem of making the baffle box work; if we had a problem in getting the pipe up I have forgotten it.

Q. Do you remember that there was brought out there, and you have already testified that you could have any equipment that you wanted, whatever you asked for, there was brought out there a large rubber pressure pipe that you hooked up after you had your trouble with some other pipe, and when you ran the Hackley gun into it it blew up from end to end?

A. No, I do not.

Q. You do not remember that?

A. I do not remember that. [906] I remember we had a long piece of pipe that we used in the forward end with a view to pulling it back.

(Testimony of Lewis Michael Larson.)

Q. Was that a rubber pipe?

A. That might have been the one to which you refer. I don't remember its set-up. It might have been down.

Q. Do you remember a rubber pipe?

A. A rubber hose?

Q. Yes. A. Yes, I remember it.

Q. Don't you remember that it failed on the job, it blew to pieces? A. Yes, I know that.

Q. That delayed you some, didn't it?

A. That delayed some, but it was minor compared to other problems; it added to the delay.

Q. It added to the delay? A. Yes.

Q. Then this baffle box that you had up there, when it would go to pieces, I don't know how far it went to pieces, you know more about that than I, but at least it would not function, and it was shattered by the explosions or expulsion of this material with explosive force so that you would have to have a man up there or men up in there to repair it frequently?

A. I am afraid too frequently.

Q. It was quite a frequent thing?

A. It was quite a frequent occurrence.

Q. You had a great deal of trouble with it?

A. Yes.

Q. When you went over to the north tunnel you did not use that baffle box?

A. No, the District Engineer was willing there to give us cooperation and it helped very materially

(Testimony of Lewis Michael Larson.)

by letting us pour the walls at a height of about 15 feet and pouring one wall and then pouring another, a very material help.

Q. You had two Hackley guns to do it?

A. Possibly.

Q. There was another one on the job before you started to pour? A. That is possible.

Q. During this time when you were having this trouble with the [907] baffle box you mentioned the insistence of the District Representative that you get into these forms and clean off the concrete that stuck to the reinforcing and stuck to the sides of the forms. A. Yes, and on the arch section.

Q. That was necessary, was it not, to get the proper forms for your concrete? You had an inch or two of what was like spattered plaster?

A. I think it was proper and there was no argument at all. It was just one of the delays.

Q. It was one of the delays? A. Yes.

Q. It was one of the delays that resulted from the method which was adopted there to do that concreting?

A. One of the delays that resulted from having to pour first one wall and then the other instead of pouring one wall at a time.

Q. One of the delays that resulted from your having to comply with the specifications in pouring concrete?

A. I would not like to say to comply with the specifications, because I don't know of anything in

(Testimony of Lewis Michael Larson.)

the specifications that precluded the pouring of one wall first and then the other wall.

Q. Although it was required by the District Engineer, and it was required that it be poured in layers not exceeding one foot if it was not a continuous pouring operation?

A. Yes, and between periods that it must be vibrated, in order to be compact, which I am not quarreling with, because it was a proper provision.

Q. It was a proper provision, and it was required for all of the concrete placed in the concrete lining? A. It was.

Q. And it resulted in a homogeneous, uniform concrete which was free from voids, as far as possible, in practical working operation?

A. That was the intent, and I believe that was accomplished, or very nearly so.

Q. Would you say that the concrete which you placed in these two sections of the southwest portals of the tunnel was placed without [908] voids?

A. I believe later developments showed that in the arch there were voids.

Q. It was necessary afterward to cut out considerable portions of that concrete, was it not?

A. So I have been advised.

Q. Wasn't that while you were there?

A. No, I was not there at the time. I poured the concrete, but the repair of it was done after I left.

Q. Didn't you see the concrete after it was placed and the forms taken out?

(Testimony of Lewis Michael Larson.)

A. Yes, I did.

Q. You saw that there were large parts of that concrete that were placed in these tunnels by the Hackley gun which had porous spots and pits in it?

A. I would not say that, because I believe that is an exaggeration of a condition. This bad concrete or these pits that you speak about I believe were not visible, and were detected later on by drilling in from the top, that is my understanding, but I think the finish against the concrete form did not show any amount of defective concrete. There were vertical cracks, but that was not the result of pockets.

Q. Part of this tunnel lining was poured in the open, I think you said it was in buggies, the very first few feet on the job? A. In the south tunnel.

Q. And no part of the north tunnel?

A. No. The north tunnel was all shot, even the portal, with the Hackley gun.

Q. But it was in the open?

A. Part of it was in the open.

Q. I will show you a photograph of the left side of the west end of the south tunnel, taken on November 20, 1934. That was shortly after it was poured and before you had started driving again while the forms were taken out?

A. That is an open section, poured by buggies.

Q. That was poured by buggies? A. Yes. [909]

Q. And you had men working there at that time?

(Testimony of Lewis Michael Larson.)

A. Let me refresh my memory on that point. Mr. Price and Mr. Stephen Bechtel kindly gave me the right to run down and visit my family, who were living in Los Angeles at the time, and I know little of this.

Q. Do you remember seeing this open section of the concrete that you poured?

A. I don't recall that. There might have been some there, but if so I do not recall it now.

The Court: Where would this be, about?

A. That would be near the portal.

Mr. Tinning: That would be right behind the portal building.

The Court: Q. You poured that in buggies?

A. In concrete buggies.

Q. Is that in the arch? A. Yes.

Mr. Tinning: Q. That was out in the open. Here is the face of the hill, and the building was right here, 30 feet out in the open.

Mr. Tinning: We will offer this photograph in evidence as Defendant's Exhibit in the proper order.

The Court: It may be admitted and marked.

(The photograph was marked "Defendant's Exhibit L.")

[Set forth in the Book of Exhibits at Page 361.]

Mr. Tinning: Mr. Wittschen suggests that when we took our recess no order was made admitting it. May such an order be made?

The Court: Yes.

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Q. I show you a photograph of the north side of the south tunnel, showing the concrete after the forms were removed, on November 20, 1934. Is that a fair representation of the condition of the concrete as it was disclosed on that portion of the tunnel that was poured in the open?
[910]

A. That was during my absence, too, but I know one thing, that it is better concrete than the buggy concrete.

Q. Better than the buggy?

A. It has that appearance.

Q. It shows those voids and rough spots?

A. It has rock pockets.

Q. It shows that there had been a segregation and at least at these points that the vibration did not result in homogeneous concrete mixing?

A. Yes, possibly due to the reinforcing preventing it, or lack of necessary amount of vibration.

Q. Maybe the men just missed that?

A. Yes, that is possible.

Q. But that was the result? A. Yes.

Q. That was placed by the Hackley gun?

A. That was placed by the Hackley gun.

Mr. Tinning: We offer this photograph in evidence, your Honor, as Defendant's Exhibit M.

The Court: Admitted.

(The photograph was marked "Defendant's Exhibit M.")

[Set forth in the Book of Exhibits at Page 362.]

(Testimony of Lewis Michael Larson.)

Mr. Tinning: Q. Did you see the concrete on the inside of the tunnel after the forms were stripped?

A. You are referring now to the 92 feet and 110 feet?

Q. Yes, we are dealing with that.

A. Yes, I stripped both of them so I naturally would see it.

Q. Were there any voids or rough spots in that concrete?

A. I have not any definite recollection of it, but it is not unusual in concrete; it would be rather surprising if it did not have some.

Q. Now, at the time you were doing this concrete work at the face, these two ring sections, how was the dirt moved from the tunnel to wherever it was finally deposited?

A. You are now again referring to the removal of the dirt in the 92 feet?

Q. We are confining our attention to that solely at this time. [911]

A. I think the majority, as I recall it, Mr. Tinning, most of the drift muck was carried from cars to cars and deposited directly into the fill. I won't say the most of it, but I think a good portion of it, and at a later period I think dumped into bunkers and hauled by trucks into the fill, but just the stage of the progress I have forgotten.

Q. Isn't it a fact that when you started your excavation there about August 23rd that you had

(Testimony of Lewis Michael Larson.)

a railroad system for the disposition of your earth that ran down along the District or the projected right of way some 2500 or 3000 feet, with a couple of trestles in it?

A. With Diesel locomotives, yes.

Q. That were used and designed to be used outside of the tunnel? A. Yes.

Q. And that at the beginning of your excavation the earth was placed in the muck cars and taken down this railroad track to the dump some 2,500 or 3,000 feet down the hill, down the valley, along the line?

A. That is substantially correct.

Q. You had a lot of trouble with that railroad, didn't you?

A. We had trouble with the Diesel engine, the equipment was faulty.

Q. They ran away going down the hill?

A. The brakes broke.

Q. And the cars would pile up? A. Yes.

Q. And your locomotives went off the track and your cars went off the track? A. Yes.

Q. And so you were delayed in getting the muck out of the tunnel at certain times, weren't you?

A. That may be true, but I am not sure that caused us any delay inside of the tunnel. I know it caused delay on the outside, but we had a reserve of cars, and it is my thought at the present time, without refreshing my memory on it, that it might have caused little or no delay inside.

(Testimony of Lewis Michael Larson.)

Q. Isn't it a fact that on several occasions the whole thing went [912] off the track, cars and engine, and you were tied up for six or seven hours while the locomotive was being placed back on the track?

A. I believe the time was greatly exaggerated, but I will admit that the out-haul locomotives and cars were derailed on either two or three or maybe four occasions, but we had another locomotive that was spotting cars in the tunnel, and that is why I feel reasonably sure that there might have been no delay to the tunnel work.

Q. Your testimony is now then that there was no substantial delay in the tunnel driving operation, in those two initial operations, by reason of the failure of the railroad equipment?

A. That is my recollection, Mr. Tinning.

Q. You said that when you were driving these tunnels that you had expected to place the concrete, to keep the concrete lining within 300 or 350 feet of the excavated face.

A. That was my thought in making the estimate, yes.

Q. When you left the job on April 30 you were in some 500 feet, weren't you? A. Yes.

Q. And the south tunnel was in approximately 100 feet further? A. 610, I think.

Q. And there had been placed in November, the latter part of November, concrete 92 feet at the

(Testimony of Lewis Michael Larson.)

mouth of the tunnel, the south tunnel, and 110 feet at the mouth of the north tunnel, so that there was approximately 400 feet of excavated and timbered and unlined tunnel in the north bore which you were in charge of, and approximately 500 feet in the south bore timbered and unlined tunnel?

A. I believe that is substantially correct.

Q. At that time there was no concrete steel form in either tunnel, was there?

A. No, not in the tunnel.

Q. They were not on the job, were they?

A. I believe not.

Q. You never saw them on the job before you left on April 30? [913]

A. My recollection is that I did not.

Q. And they were big enough when you did see them so that you would have known if they had been there? They were not concealed behind a pine tree or building somewhere?

A. That is true.

Q. They were not there, were they?

A. I believe they were not there.

Q. And when you returned to the job on August 29th there was approximately 1,000 feet of excavated tunnel in each of the bores, was there not—I am not talking about where it fell in.

A. Well, you may be approximately correct; I have the data on that but I have not in my mind.

Q. I do not think it is important to get the exact

(Testimony of Lewis Michael Larson.)

footage, but the statement that I made is a fair statement of the general condition, there was approximately 1,000 feet of each tunnel that had been excavated when you returned at the end of August?

A. I should say approximately.

Q. And did you observe how much concrete lining had been placed in the tunnel, or in either bore or both bores from the time that you left on April 30th and the time that you returned on August 29th?

A. I said in my previous evidence that I believed 80 feet in the north tunnel and between 200 and 300 feet in the south tunnel, and later I observed that there was some 70 feet in the north tunnel instead of 80 feet, and somewhere in the vicinity of a little bit under 200 feet additional in the south tunnel.

Q. So if the District records show that there was 160 feet of additional concrete in the tunnels at that time in addition to the original amount that you poured in October of the preceding year you would feel that those records would be wrong?

A. I would be inclined to think—are you taking the amount in both tunnels, or one?

Q. 160 feet in addition to what had been poured before, which [914] was distributed in the two tunnels.

A. I would be inclined to think that is under the amount. I am inclined to think from the company's records showing the date when the concrete was poured it shows more than that.

(Testimony of Lewis Michael Larson.)

Q. When was that first concrete poured in the steel forms in the tunnel?

A. That I could not recall now. I would have to go to my records for that.

Q. It was right around August 1, 1935?

A. I think some was poured—wasn't there some poured in June—it seems to me it was.

Q. Of course, you are testifying to something that you have been reading from in your preparations?

A. Surely.

Q. I do not want to bind you on that, but your impression now is that concrete was poured in the tunnels in June?

A. It seems in the south tunnel it began in June. That is my recollection of the record.

Q. Isn't it a fact that the Six Companies did not have a concrete plant at the west portal set up for operation until the latter part of June, 1935?

Mr. Marrin: Why ask this witness all of these questions? He testified he was not there at that time. I think it is objectionable as calling simply for hearsay. He does not know about it.

Mr. Smith: He said he left there on April 30 and did not go back until August 29.

Mr. Marrin: I think these facts can be brought out clearly from other witnesses.

The Court: He has stated that he prepared himself as a witness by consulting the records, and he has testified to facts. He has testified in both capacities, and I think both sides recognize that, and

(Testimony of Lewis Michael Larson.)

probably counsel has that in mind, I do not know.

[915]

Mr. Marrin: I have no particular objection, your Honor, except that if Mr. Tinning is asking for facts—

The Court: Do you or do you not know any of these matters, "Yes" or "No"?

A. I don't know definitely.

Mr. Tinning: Q. But it is a fact that when you returned there that there had been a very small amount of concrete, and according to your statement around 300 feet poured in addition to what was poured in November of 1934 at the face?

A. I would say a little under 300, Mr. Tinning.

Q. A little under 300? A. Yes.

Q. That would mean that there were several hundred feet of full excavated tunnel with the timbers in it standing exposed to the air, and which could result in slaking and exfoliation for a period of seven or eight months?

A. You are speaking now, of course, of the time of the first exposure of the ground?

Q. Yes.

A. Yes, the period of time from the time the ground was uncovered up to the time of August that you speak of, will be approximately what you said.

Q. And during that period the materials in the tunnel were open to whatever effect air and moisture in the air could bring to them?

(Testimony of Lewis Michael Larson.)

A. Under the conditions that existed?

Q. Under the conditions that existed.

A. Yes.

Q. And the distance from the excavated face to the concrete was far in excess of 300 to 350 feet, was it not?

A. That is true.

Q. And it was 700 or 800 feet?

A. You are probably correct, or approximately correct.

Q. Approximately correct?

A. Yes.

Q. Do you consider as a tunnel expert that it was good practice to leave the tunnel standing timbered and unconcreted the period of time that you have just stated it remained in that condition?

[916]

A. If the conditions of placing concrete were under control, I would say it would be advisable to have followed closer with the concrete.

Q. Will you please read the question asked, Mr. Reporter, and will you please answer it "Yes" or "No", Mr. Larson, and then explain?

A. No, I do not, if the conditions, all the conditions are under control.

Q. Well, what conditions would you say prevented the placing of concrete in this tunnel? Was it the fact that there was no concrete plant ready until the end of June, 1935, or that there were no steel forms on the ground until the middle of June, 1935?

(Testimony of Lewis Michael Larson.)

A. No, I do not have that so much in mind, Mr. Tinning as I do that the unsatisfactory method—I say unsatisfactory, because I believe that was mutual between the Six Companies and the District—that a different manner of placing concrete would be desirable, and I am testifying now from the benefit of that information, that there was an effort to introduce a Pumpcrete method, and that was largely in its infancy, and I really believe it was developed to its present stage of efficiency in this very particular tunnel, but it required a good deal of preparatory work in the way of correspondence and discussions between the District Engineer and the Six Companies to effect that.

Q. You are now testifying to your conclusions from correspondence and records that you read?

A. Yes, from information that has come to me since.

Q. However, you knew at the time you prepared your estimate that the Pumpcrete method had been or was being used at the Boulder Tunnel?

A. Unsatisfactorily.

Q. Unsatisfactorily?

A. Yes, in filling the arch.

Q. Was there any condition that prevented the placing of concrete? [917] You had Hackley guns?

A. I do not know, Mr. Tinning. Of course, if we tied ourselves to 350 feet then I would have to admit that the forms were not ready at the time that we had reached the 350 feet, but I will also

(Testimony of Lewis Michael Larson.)

be fair to both parties and say that the form erection was also delayed, and, as I understand it, by the effort to get Pumcrete equipment on the job. What other conditions controlled I am really not in a position to say.

Q. It is all again a conclusion from your consultation of records? A. That is correct.

Q. It was the contractor's duty to get the concrete in, was it not? The method that he used was, so long as he fulfilled the specifications, was his problem?

A. It was his problem to get the concrete in, that is true, by a method that would be satisfactory to the owners.

Q. That is, that would comply with the specifications?

A. That would comply with the specifications.

Q. In other tunnels you had used the Hackley gun and had been able to comply with the specifications and get a good job?

A. That is true, but we were not tied down, in fairness, we were not tied down to the same specifications that we were in this particular instance; in all previous jobs, in the Hollywood Tunnel, for example, we were permitted to pour one wall and then finish up pouring the arch, and in the Claremont Tunnel to pour from the center and allow it to flow down the side.

Q. The Claremont Tunnel was not comparable

(Testimony of Lewis Michael Larson.)

—it was a water tunnel, and it was about the same size as one of these drifts?

A. It was not comparable in size, no, Mr. Tinning.

Q. The Hollywood Tunnel was comparable in size, was it?

A. Except for height.

Q. And the height was what caused you your trouble with the Hackley [918] gun, was it not?

A. No, I would not say that, that would not be a fair conclusion; it was not the height alone that gave us the trouble. We would have had the same trouble if we had taken one of these contracts and been compelled to deflect the concrete in the manner prescribed by the specifications. I am not going to say that the method was wrong or that it was an unreasonable requirement. I am trying to answer your questions intelligently. I—

Q. (Interrupting) It was a requirement—

Mr. Smith: Just a minute, let him finish.

Mr. Tinning: He stopped, and I thought he had finished. I am sorry. What were you going to say?

A. I have forgotten my drift. Go ahead with the next question.

The Court: We will take an adjournment now until tomorrow morning at ten o'clock.

(An adjournment was here taken until tomorrow, Friday, April 22, 1938, at ten o'clock a. m.)

[919]